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(54) **CHANNEL SELECTION IN DIGITAL TELEVISION**

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Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(51) **Int. Cl.**[7] **H04N 5/445**; H04N 5/54; H04N 7/00; H04N 5/50

(52) **U.S. Cl.** **348/732**; 348/731; 348/569; 348/563; 725/57; 725/56

(58) **Field of Search** 348/731, 734, 348/385.1, 386.1, 569, 906, 563, 553, 732, 570; 725/56, 44, 151, 20, 57

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(57) **ABSTRACT**

Methods and apparatus implementing a technique for selecting a channel in a digital television. In one implementation, selecting a channel includes: receiving a major and minor channel number sequence, including a major channel number, a delimiter, and a minor channel number, where the delimiter separates the major channel number and the minor channel number; identifying a physical channel which corresponds to the major and minor channel number sequence by accessing a channel look up table, where the channel look up table includes correspondences between major and minor channel number sequences and physical channels; identifying a virtual channel table which corresponds to the physical channel, where the virtual channel table indicates a virtual channel which corresponds to the major and minor channel number sequence; tuning to the physical channel to receive a signal carried on the physical channel; and decoding the virtual channel from the tuned signal.

18 Claims, 7 Drawing Sheets

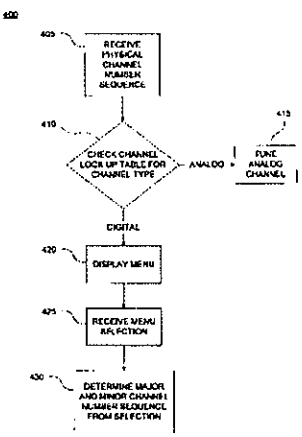

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FIG. 1A

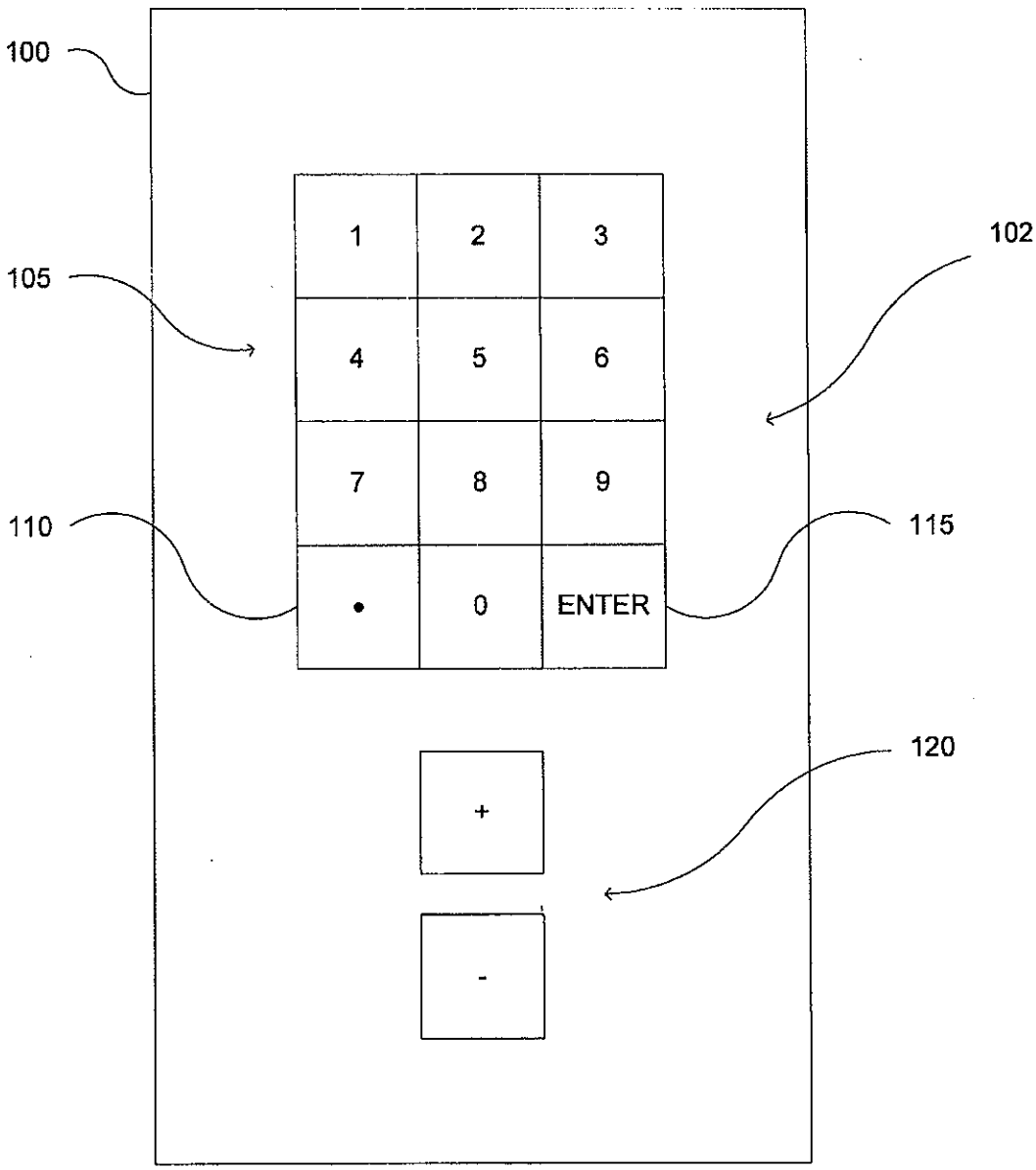

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FIG. 1B

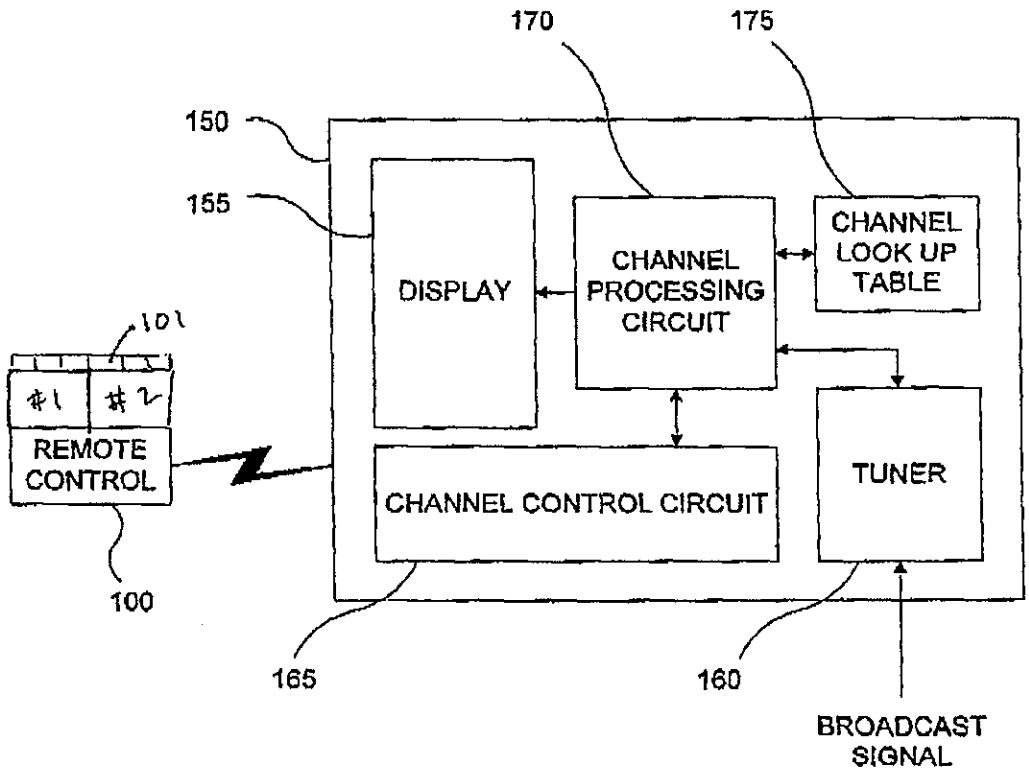

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FIG. 2A

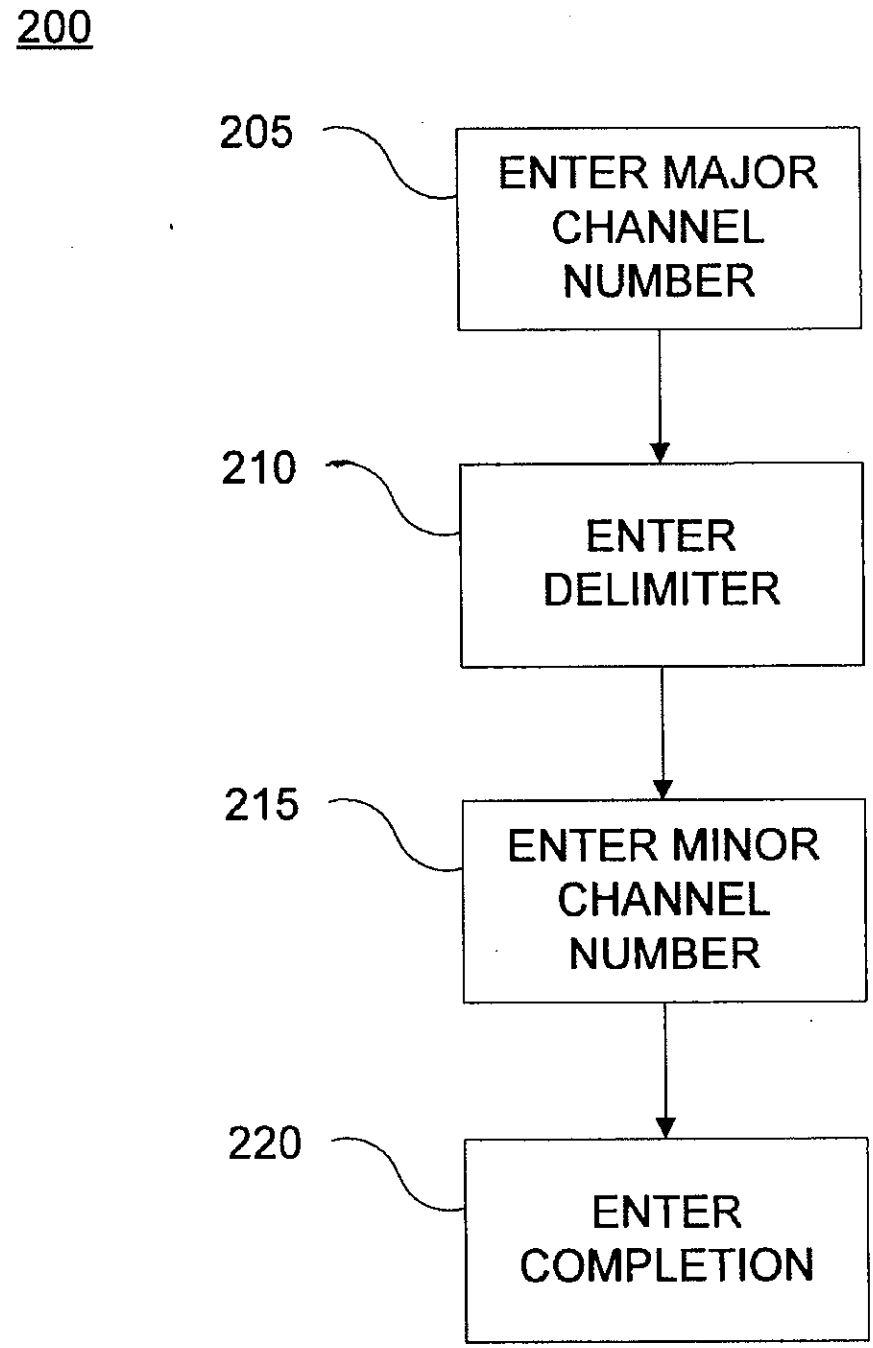

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FIG. 2B

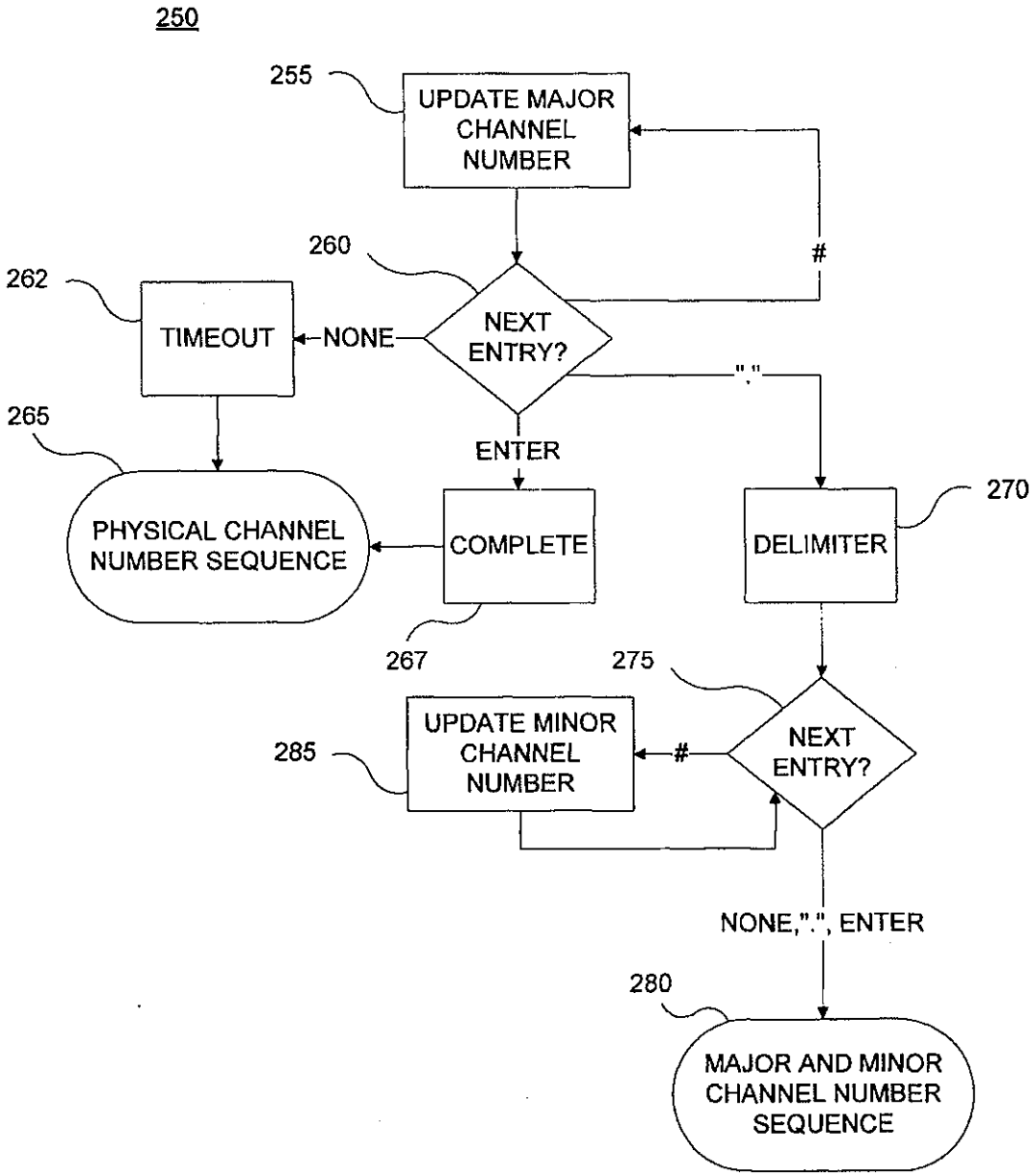

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FIG. 3

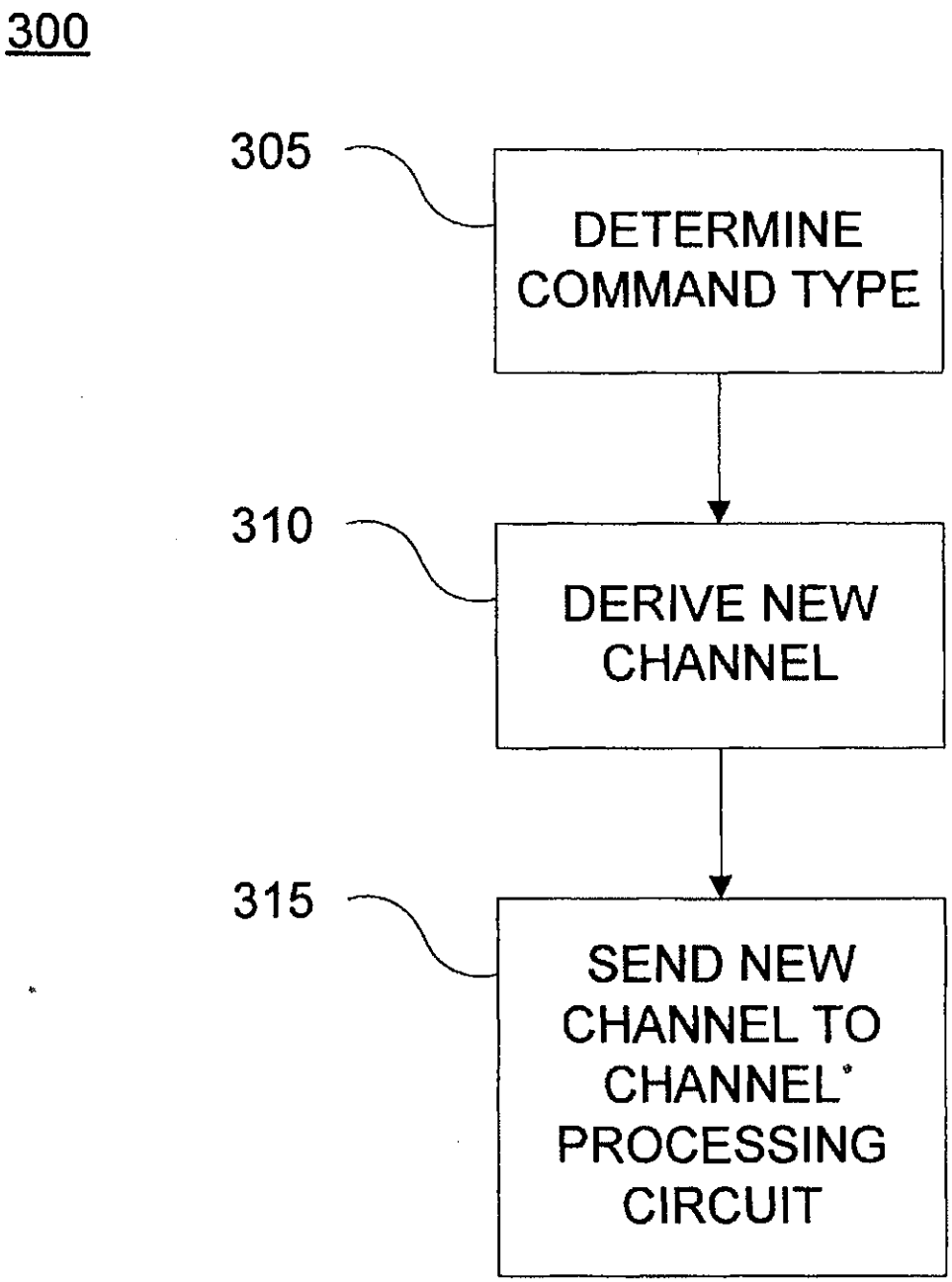

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FIG. 4

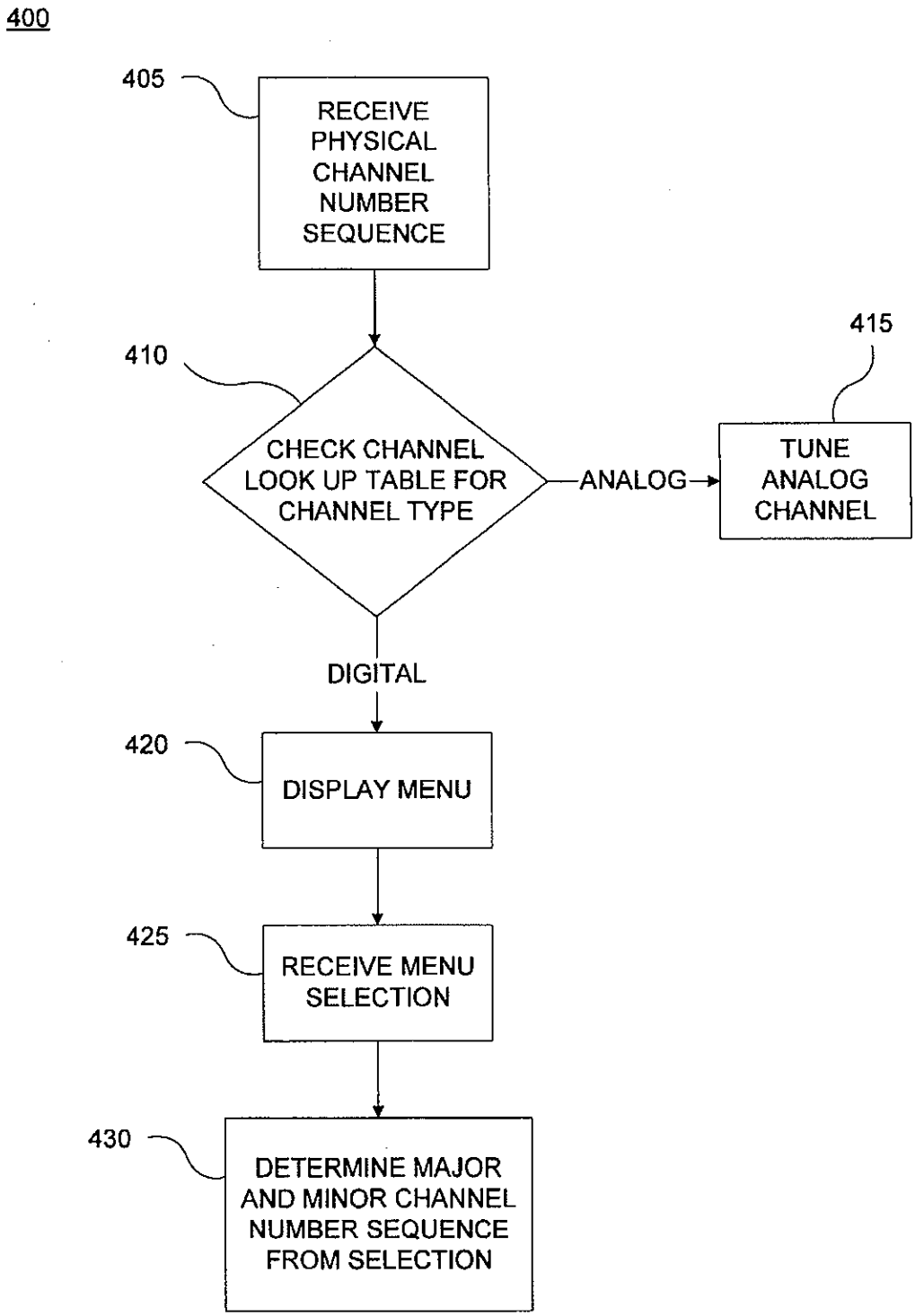

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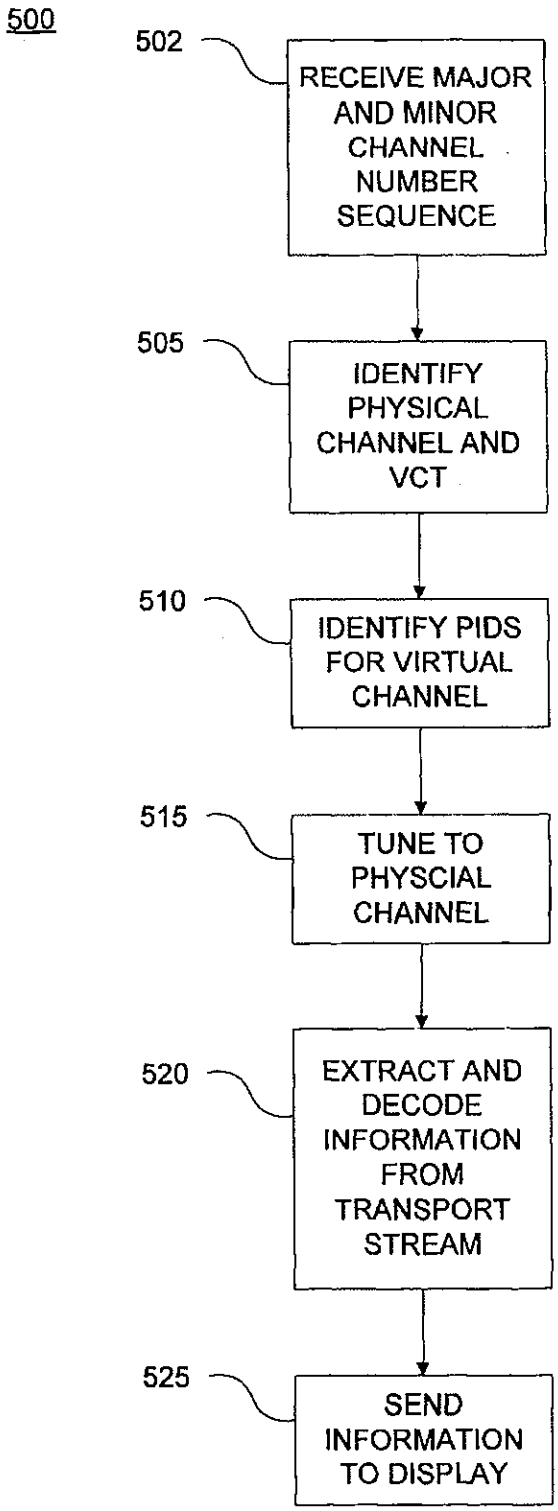
FIG. 5



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CHANNEL SELECTION IN DIGITAL TELEVISION

This application claims the benefit of U.S. Provisional Application No. 60/102,942, filed Sep. 30, 1998.

BACKGROUND

To view a television program being transmitted to a user's television, the user provides a channel number to the television. In conventional analog broadcast television, this channel number is a reference to a particular frequency band at which the analog signal carrying the television program is broadcast. This frequency band is also referred to as a "physical channel." The channel number identifies from which frequency band a tuner in the television is to receive. Thus, a channel number indicates a physical channel and the associated program.

In digital broadcast television, a frequency band can carry a signal which is an encoded digital transport stream. When decoded, the transport stream can include one or more streams having various forms of content, such as video or audio for a program, text based information, closed captioning, or any information which can be transmitted digitally. Each of these items can be associated with a different channel number. Accordingly, a single physical channel can include multiple items or "virtual channels." In this case, a channel number refers to a virtual channel, a particular item encoded within a transport stream, instead of referring to a physical channel.

In addition, content in a transport stream can be related to content broadcast as an analog signal or in a different transport stream. For example, a transport stream can include a high definition television ("HDTV") version of a program that is also broadcast as an analog signal at a different unrelated frequency band.

SUMMARY

The invention provides methods and apparatus implementing a technique for selecting a channel in a digital television. In one implementation, selecting a channel includes: receiving a major and minor channel number sequence, including a major channel number, a delimiter, and a minor channel number, where the delimiter separates the major channel number and the minor channel number; identifying a physical channel which corresponds to the major and minor channel number sequence by accessing a channel look up table, where the channel look up table includes correspondences between major and minor channel number sequences and physical channels; and identifying a virtual channel table which corresponds to the physical channel, where the virtual channel table indicates a virtual channel which corresponds to the major and minor channel number sequence. Selecting a channel can further include: tuning to the physical channel to receive a signal carried on the physical channel; and decoding the virtual channel from the tuned signal.

In another aspect, an input device for selecting a channel in a digital television includes: a keypad including a plurality of number keys for inputting respective numbers; and a delimiter key for inputting a delimiter, where a channel is indicated by a major and minor channel number sequence which includes a major channel number input through one or more number keys of the keypad, a delimiter input through the delimiter key, and a minor channel number input through one or more number keys of the keypad.

In another aspect, a digital television includes: a display; a tuner including a connection for an externally supplied broadcast signal, where the tuner provides a signal carried on a physical channel selected from the broadcast signal; a channel control circuit which derives major and minor channel number sequences from received control signals, where a major and minor channel number sequence indicates a specific channel carried in the broadcast signal; a channel processing circuit connected to the channel control circuit, the display, and the tuner, where the channel processing circuit causes the tuner to select a physical channel corresponding to the major and minor channel number sequence supplied by the channel control circuit and provide a digital signal carried thereon, decodes a channel indicated by the major and minor channel number sequence in the digital signal, and supplies the decoded channel to the display.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A shows a hand-held remote control which provides efficient input of major and minor channel numbers to select a channel on a digital television.

FIG. 1B shows a remote control and a digital television.

FIG. 2A is a flowchart of a process for directly entering channel numbers for a major and minor channel number sequence using a keypad.

FIG. 2B is a flowchart of a process for processing number sequences entered using a keypad.

FIG. 3 shows a process for selecting a channel using channel commands.

FIG. 4 is a flowchart of a process for selecting a virtual channel through a menu shown on a display.

FIG. 5 is a flowchart of a process for processing major and minor channel number sequences in a digital television.

DETAILED DESCRIPTION

The Advanced Television System Committee ("ATSC") established a standard protocol for transmission of data tables for use with digital television. This protocol is referred to as the Program and System Information Protocol ("PSIP") and is described in "Program and System Information Protocol for Terrestrial Broadcast and Cable," document A/65, Dec. 23, 1997 published by the ATSC. The information describing the content of a transport stream for a physical channel is referred to as the PSIP for that physical channel.

In digital television, each channel in a transport stream is a virtual channel associated with a major channel number and a minor channel number. A major channel number can be used to identify channels which belong to a common broadcast corporation or other group. A minor channel number specifies a particular channel in such a group. In one example, all the virtual channels in a transport stream have the same major channel number and have respective minor channel numbers. In addition, virtual channels can have as a major channel number the channel number of a physical channel carrying a related analog channel (analog channels do not need minor channel numbers). In another example, a program is transmitted as an analog signal on physical channel 2. The HDTV version of the same program is transmitted in a transport stream, such as within an unrelated frequency band on a different physical channel, and the virtual channel for that HDTV program has the major channel number 2. Thus, a physical channel can be indicated by a major channel number and a virtual channel can be indicated by a major and minor channel number pair.

The PSIP describes the information for all the virtual channels in a transport stream. The PSIP includes a virtual

channel table ("VCT") which describes the correspondence between major and minor channel numbers and the virtual channels. A digital television uses the VCT to interpret a user's input to select the appropriate major and minor channel number and hence the desired virtual channel.

FIG. 1A shows an implementation of an input device as a hand-held remote control **100** which provides efficient input of major and minor channel numbers to select a channel on a digital television. Remote control **100** includes at least one keypad **102**. Keypad **102** includes one or more number keys **105**, such as 10 number keys labeled 0–9, a delimiter key **110**, an enter key **115**, and one or more channel command keys **120**, such as keys labeled with plus ("+") and minus ("–"). In an alternative implementation, a keypad includes alphanumeric keys so that a user can enter combinations of letters and/or numbers to identify a channel, such as "SNN.HDTV". Alphanumeric labels can be set by the user or provided automatically, such as through a broadcast signal in a transport stream.

A user enters channel numbers by depressing one or more number keys **105**. A user indicates the separation between a major channel number and a minor channel number by depressing delimiter key **110**. A sequence of a major channel number, a delimiter, and a minor channel number is a major and minor channel number sequence. Because delimiter key **110** is provided on remote control **100**, a user can conveniently enter a major and minor channel number sequence to access a specific channel directly.

Delimiter key **110** is marked with a delimiter. In FIG. 1A, delimiter key **110** is marked with a dot ("."). This delimiter can take any form, for example, and not by way of limitation, a slash ("/"), a space (" "), or a dash ("-"). The choice of a dot as the delimiter is advantageous as being a familiar break in numeric representation in the decimal system. In one implementation, the delimiter is implemented as a predetermined break or arrangement of memory storage, rather than a separately stored character. In another implementation, the delimiter is indicated by inputting a major channel number with a first keypad and a minor channel number with a second keypad (shown in FIG. 1B).

To complete a channel number entry, the user can depress enter key **115**. An automatic timeout can also complete a channel number entry if the user does not depress any key for a specified period. The user enters channel commands by depressing one of one or more channel command keys **120**, such as to change to a sequentially adjacent channel. For example, in one implementation, to change from the current channel to the sequentially next channel, the user can depress a channel command key **120** marked with a plus ("+").

FIG. 1B shows remote control **100** and a digital television **150**, with the control **100** potentially having one or more keypads (two shown) and alphabet keys **101**. Digital television **150** includes a display **155**, such as a cathode ray tube ("CRT"), a tuner **160**, a channel control circuit **165**, and a channel processing circuit **170**. These components can be implemented separately or in combination. In one implementation, digital television **100** also includes an integrated keypad for entry of channel numbers and commands directly into digital television **150**.

Remote control **100** sends control signals to digital television **150** according to keys depressed by the user. Channel control circuit **165** receives the control signals. Channel control circuit **165** recognizes channel commands or combinations of channel numbers and delimiters to select a desired physical or virtual channel. For example, in an implementation where the delimiter is a dot, channel control circuit **165** recognizes the sequence "4.2" as a request for major channel number 4 and minor channel number 2. Channel selection is described further below with respect to FIGS. 2A through 5. Channel control circuit **165** provides channel information, such as major and minor channel numbers, to channel processing circuit **170**.

Channel processing circuit **170** uses the channel information from channel control circuit **165** and information stored in a channel look up table **175** to determine the desired physical or virtual channel. Channel look up table **175** is implemented as writeable memory, such as RAM or flash ROM. Channel processing circuit **170** creates channel look up table **175** during initialization of digital television **150** and updates channel look up table **175** dynamically. Channel look up table **175** defines correspondences between major and minor channel numbers and physical and virtual channels. The allocation of minor channel numbers is derived from information obtained from the PSIP of digital physical channels. Major channel numbers correspond to physical channels, which may be different from the physical channels carrying the transport streams. Channel look up table **175** also indicates whether each physical channel is an analog channel or a digital channel.

Channel processing circuit **170** causes tuner **160** to select a physical channel from a broadcast signal received at digital television **150**. The broadcast signal can be received through various reception systems, such as an antenna, a cable system (e.g., CATV), or a satellite system (e.g., DSS). Tuner **160** provides a signal on the selected physical channel to channel processing circuit **170**.

When the channel information indicates a physical channel is desired, such as an analog channel, channel processing circuit **170** passes the signal from tuner **160** to display **155** unchanged. When the channel information indicates a virtual channel is desired, channel processing circuit **170** performs appropriate digital signal processing to extract information from a transport stream based on information supplied in the VCT. For example, channel processing circuit **170** can extract and decode, using decoding such as MPEG-2, a video signal and an audio signal from a transport stream which corresponds to a desired virtual channel. Channel processing circuit **170** provides the signal or signals to display **155**.

FIG. 2A is a flowchart of a process **200** for directly entering channel numbers for a major and minor channel number sequence using a keypad, such as keypad **102** shown in FIG. 1A. A user enters a major channel number by depressing an appropriate number key or keys **105** (**205**). The user enters a delimiter by depressing delimiter key **110** (**210**). As discussed above, the delimiter indicates the end of the major channel number. For example, the delimiter allows a user to enter directly and distinguishably the sequences "42.3" and "4.23." The user enters a minor channel number by depressing an appropriate number key or keys **105** on remote control **100** (**215**). The user completes the sequence by depressing enter key **115** (**220**). The major channel number, delimiter, and minor channel number can be supplied to the channel control circuit separately or together.

FIG. 2B is a flowchart of a process **250** for processing number sequences entered using a keypad, such as keypad **102** shown in FIG. 1A, to generate a channel number sequence in a digital television, such as in channel control circuit **165** shown in FIG. 1B. As described above, a major and minor channel number sequence includes a major channel number, a delimiter, and a minor channel number. A physical channel number sequence includes a channel number.

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When channel control circuit **165** receives an entry of a channel number, and is not already processing another channel number sequence, channel control circuit stores the received number as the first digit of a current channel number (**255**). Channel control circuit **165** causes display **155** to display the received channel number and entries as entries are received for user feedback. Channel control circuit **165** waits to receive another entry for a specified timeout period (**260**). If channel control circuit **165** does not receive another entry before the timeout period expires (**262**), channel control circuit **165** passes the current channel number to channel processing circuit **170** as a physical channel number sequence (**265**). If channel control circuit **165** receives a completion signal, such as from enter key **115**, before the timeout period expires (**267**), channel control circuit **165** passes the current channel number to channel processing circuit **170** as a physical channel number sequence (**265**).

If channel control circuit **165** receives another channel number before the timeout period expires, channel control circuit **165** concatenates the new channel number with the current channel number as the next digit (**255**). Channel control circuit **165** resets the timeout period to wait for another entry (**260**).

If channel control circuit **165** receives a delimiter before the timeout period expires, channel control circuit **165** concatenates the delimiter with the current channel number (**270**). Channel control circuit **165** resets the timeout period to wait for another entry (**275**).

If channel control circuit **165** does not receive another entry before the timeout period expires, channel control circuit **165** passes the current channel number to channel processing circuit **170** as a major and minor channel number sequence (**280**). If the current channel number ends with a delimiter, channel control circuit **165** concatenates a default value, such as zero, with the current channel number before passing the current channel number to channel processing circuit **170**.

Similarly, if channel control circuit **165** receives a completion signal, such as from enter key **115**, or a second delimiter before the timeout period expires, channel control circuit **165** passes the current channel number to channel processing circuit **170** as a major and minor channel number sequence (**280**). If the current channel number ends with a delimiter, channel control circuit **165** concatenates a default value, such as zero, with the current channel number before passing the current channel number to channel processing circuit **170**.

If channel control circuit **165** receives another channel number before the timeout period expires, channel control circuit **165** concatenates the new channel number with the current channel number as the next digit (**285**). Channel control circuit **165** resets the timeout period to wait for another entry (**275**).

For example, to select physical channel 2, an analog channel, a user enters "2" with a number key **105** and then "ENTER" with enter key **115** using remote control **100** as shown in FIG. 1A. To select virtual channel 4.2—the virtual channel which has major number channel 4 and minor channel number 2—a user enters "4" with a number key **105**, "." with delimiter key **110**, and then "2" with a number key **105**.

FIG. **3** shows a process **300** for selecting a channel using channel commands, such as using channel command keys **120** as shown in FIG. 1A. When channel control circuit **165** receives a channel command, channel control circuit **165** determines the type of command (**305**). Channel control circuit **165** recognizes a predetermined set of commands, such as those which are available through remote control **100**. Channel control circuit **165** processes the channel command to derive the desired channel (**310**). Channel control circuit passes the resulting channel number to channel processing circuit **170** as a channel number sequence (**315**).

An analog channel is sequentially before virtual channels with the same major channel number as the channel number of the analog channel. For example, when channel control circuit **165** has received a "+" command and the currently displayed channel is 4, channel control circuit **165** sends a request to channel processing circuit **170** for the next sequential channel. Channel processing circuit **170** checks whether virtual channel 4.1 is available and, if not, whether analog channel 5 is available, and so on. Channel processing circuit **170** returns the resulting channel number to channel control circuit **165**, or alternatively can process the channel number directly.

FIG. **4** is a flowchart of a process **400** for selecting a virtual channel through a menu shown on a display, such as display **155** shown in FIG. 1B. When channel processing circuit **170** receives a physical channel number sequence from channel control circuit **165** (**405**), channel processing circuit **170** checks in the channel look up table **175** whether the selected physical channel is a digital or analog channel (**410**). If the physical channel is an analog channel, channel processing circuit **170** causes the tuner **160** to tune to the physical channel to display the broadcast signal on display **150** (**415**).

If the physical channel is a digital channel, channel processing circuit **170** causes display **150** to display a menu listing one or more virtual channels associated with that physical channel (**420**). To generate the menu, channel processing circuit **170** accesses the VCT of the transport stream on the physical channel. Alternatively, channel processing circuit **170** generates a full channel list of all the channels, virtual and analog, that have the same major channel number as the major channel number which corresponds to the selected physical channel.

In one implementation, channel processing circuit **170** always generates a full channel list for the selected physical channel, whether the physical channel is analog or digital. For example, in the case of an analog physical channel, channel processing circuit **170** obtains the major channel number corresponding to the selected analog physical channel from the channel look up table **175**. Channel processing circuit **170** forms the full channel list by searching channel look up table **175** for all the virtual channels which have that major channel number.

Channel processing circuit **170** receives a selection from the menu made by the user (**425**). The user can select entries from menus in various ways, such as by using channel command keys **120** shown in FIG. 1A. Channel processing circuit **170** uses channel look up table **175** to find major and minor channel numbers corresponding to the selected entry and uses these numbers as a major and minor channel number sequence (**430**).

FIG. **5** is a flowchart of a process **500** for processing major and minor channel number sequences in a digital television, such as digital television **150** shown in FIG. 1B. After receiving a major and minor channel number sequence (**502**), channel processing circuit **170** identifies a physical channel and VCT associated with that sequence using channel lookup table **175** (**505**). For example, upon receiving the

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major and minor channel number sequence "4.2" (i.e., a sequence having major and minor channel numbers 4 and 2, respectively), channel processing circuit **170** accesses channel lookup table **175** to determine the associated physical channel, such as physical channel 39. Channel processing circuit **170** also accesses the VCT for physical channel 39, such as through a pointer to the VCT stored in channel lookup table **175**. Channel processing circuit **170** retrieves one or more packet identifiers ("PIDs") from the accessed VCT for packets in the transport stream on the selected physical channel which correspond to the selected virtual channel **(510)**. As described above, a major and minor channel number sequence indicates a virtual channel. A single virtual channel can have associated multiple information streams. For example, the VCT may indicate that video data for the selected virtual channel has one PID and audio data has another PID.

Channel processing circuit **170** causes tuner **160** to tune to the selected physical channel **(515)**. Channel processing circuit **170** extracts and decodes appropriate information from the signal received on the tuned physical channel using the retrieved PID or PIDs **(520)**. Channel processing circuit **170** supplies this information to display **155 (525)**. Channel processing circuit **170** can also supply audio or other information to appropriate components of digital television **150**.

The invention can be implemented in, or in combinations of, digital electronic circuitry, computer hardware, firmware, or software. An implementation can include one or more stored computer programs executable by a programmable system including a programmable processor and memory.

In the implementations described above, information describing virtual channels and mapping between channel numbers and virtual channels and physical channels is carried in the PSIP of digital channels. In alternative implementations, however, this information can be supplied in various ways or in a combination of ways. This mapping information can be provided by out-of-band ("OOB") signaling, such as in CATV. Alternatively, the mapping information can be provided by in-band signals, such as program guide and mapping information provided on a portion of an analog or digital channel. The information can be provided in real time or periodically, on a single channel or multiple channels. For example, in one such implementation, the channel processing circuit of a digital television builds the channel look up table by combining the mapping information received on multiple channels. A person of ordinary skill in the art will know how to modify the components of the digital television described above to accommodate one or more of these alternative information sources, such as by including additional tuners or software to access and store the mapping information.

In another alternative implementation, the channel selection is used to select a channel without tuning to that channel. For example, a user can select a channel as described above for recording at some future time. In this case, the digital television does not necessarily tune to the selected channel at the time of selection.

This disclosure describes numerous implementations of the invention. However, these implementations are illustrative and not limiting. Additional variations are possible and will be apparent to one of ordinary skill in the appropriate art.

What is claimed is:

1. A digital television, comprising:

a display;

a tuner including a connection for an externally supplied broadcast signal, where the tuner provides a signal carried on a physical channel selected from the broadcast signal;

a channel control circuit which derives major and minor channel number sequences from received control signals, where a major and minor channel number sequence indicates a specific channel carried in the broadcast signal;

a channel processing circuit connected to the channel control circuit, the display, and the tuner, where the channel processing circuit

determines, when a physical channel indicated at least by the major channel number is digital, a major and minor channel number sequence by displaying a list of channels associated with the physical channel;

receives a selection of a minor channel from the list, and

generates a major and minor channel number sequence based thereon.

2. The digital television of claim **1**, where the received control signals include a major channel number, a delimiter, and a minor channel number.

3. The digital television of claim **1**, where the received control signals include a major channel number and a menu selection which indicates a minor channel number.

4. The digital television of claim **1**, where the channel processing circuit comprises a channel look up table which indicates correspondences between major and minor channel number sequences and physical channels.

5. The digital television of claim **4**, where the channel look up table further indicates correspondences between major and minor channel number sequences and channels encoded in digital signals carried in the broadcast signal.

6. The digital television of claim **4**, further comprising an integrated keypad for inputting the received control signals.

7. The digital television of claim **4**, further comprising an input device which includes a keypad for inputting the received control signals.

8. A method for selecting a channel in a digital television, comprising:

inputting a major channel number which indicates a first physical channel carried on a broadcast signal;

determining whether the physical channel is digital;

if the physical channel is digital, presenting a list at least of minor channel numbers associated at least with the physical channel;

using the list, inputting a minor channel number such that a major and minor channel number sequence can be generated therefrom.

9. The method of claim **1**, where the second physical channel is the same as the first physical channel.

10. The method of claim **1**, further comprising inputting a completion command to complete selecting a channel.

11. The method of claim **1**, further comprising transmitting the major channel number, the delimiter, and the minor channel number to a digital television.

12. The method of claim **11**, where the major channel number, the delimiter, and the minor channel number are transmitted to the digital television together.

13. The method of claim **1**, where the digital signal is a transport stream.

14. The method of claim **13**, where a correspondence between the minor channel number and the channel is provided by a virtual channel table carried in the transport stream.

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15. A method for selecting a channel in a digital television, comprising:

receiving a physical channel number sequence which indicates a physical channel which has a corresponding major channel number;

identifying the physical channel as analog or digital;

when the physical channel is digital, determining a major and minor channel number sequence by

displaying a menu listing one or more channels associated with the physical channel,

receiving a selection from the menu, where the selection corresponds to a channel which has a corresponding minor channel number, and

generating a major and minor channel number sequence from the major channel number corresponding to the physical channel and the minor channel number corresponding to the selection.

16. The method of claim 15, further comprising tuning to the physical channel corresponding to the major and minor channel number sequence.

17. The method of claim 15, further comprising, when the physical channel is analog, causing a tuner to tune to the physical channel to supply a signal carried on the physical channel to a display.

18. A system for selecting a channel in a digital television, comprising:

means for receiving a physical channel number sequence which indicates a physical channel which has a corresponding major channel number;

means for identifying the physical channel as analog or digital;

means for causing a tuner to tune to the physical channel to supply a signal carried on the physical channel to a display when the physical channel is analog;

means for determining a major and minor channel number sequence when the physical channel is digital, by

displaying a menu listing one or more channels associated with the physical channel,

receiving a selection from the menu, where the selection corresponds to a channel which has a corresponding minor channel number, and

generating a major and minor channel number sequence from the major channel number corresponding to the physical channel and the minor channel number corresponding to the selection.

* * * * *

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US005285285A

United States Patent [19]

Yamada et al.

[11] Patent Number: 5,285,285

[45] Date of Patent: Feb. 8, 1994

[54] **METHOD OF CONTROLLING FIRST ITEMS THAT REQUIRE PRIOR CRT DISPLAY AND SECOND ITEMS THAT REQUIRE NO PRIOR DISPLAY**

[75] Inventors: **Hisafumi Yamada**, Tokyo; **Mitsumasa Saitoh**; **Shigeyuki Sano**, both of Kanagawa; **Takao Itabashi**, Tokyo, all of Japan

[73] Assignee: **Sony Corporation**, Tokyo, Japan

[21] Appl. No.: **875,396**

[22] Filed: **Apr. 29, 1992**

[30] **Foreign Application Priority Data**

Apr. 30, 1991 [JP] Japan 3-126676

[51] **Int. Cl.**[5] **H04N 5/44**; H04N 5/445

[52] **U.S. Cl.** **348/570**; 348/734; 348/725

[58] **Field of Search** 358/192.1, 188, 194.1, 358/191.1; H04N 5/44, 5/445, 5/50, 5/57, 5/60

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Primary Examiner—Mark R. Powell
Assistant Examiner—Chris Grant
Attorney, Agent, or Firm—Lewis H. Eslinger; Jay H. Maioli

[57] **ABSTRACT**

Items related to the quality of an on-screen image such as brightness, sharpness, chroma, etc. and items related to the audio quality such as bass, treble, balance, etc. in a CRT display, such as a television receiver, are subject to adjustment by a user. These items are originally classified into those in a first class and those in a second class in accordance with the nature of a respective item, that is, whether a user must know the current analog value of the item before he or she adjusts it. When an instruction is input through user's manipulation to adjust the analog value of an item to be controlled, the system determines whether the item belongs to the first class or the second class. If it belongs to the first class, the system first confirms that the item and its actual analog value are displayed on a screen, then permits adjustment of the analog value in response to the instruction, and then displays a new analog value. If it belongs to the second class, the system permits immediate adjustment of its analog value and displays a new analog value.

3 Claims, 3 Drawing Sheets

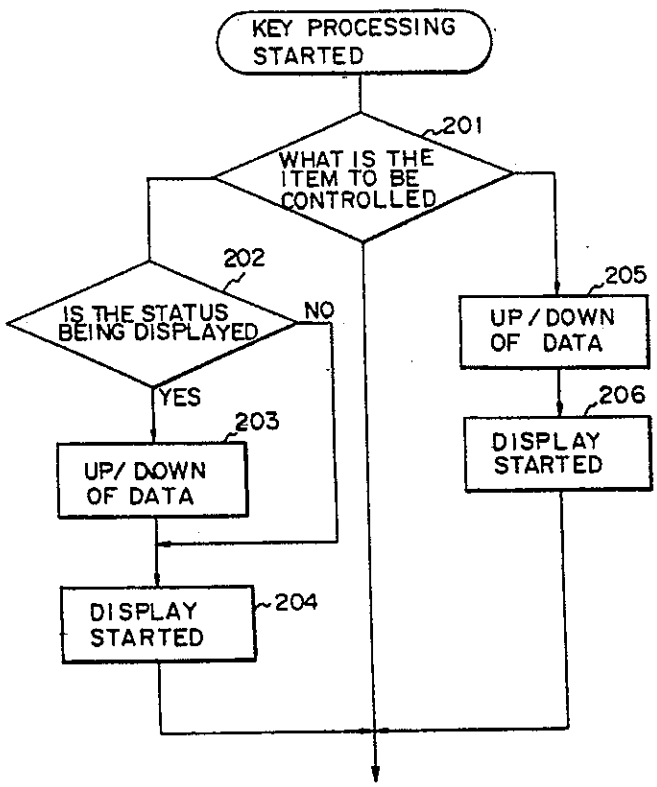

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Fig. 1

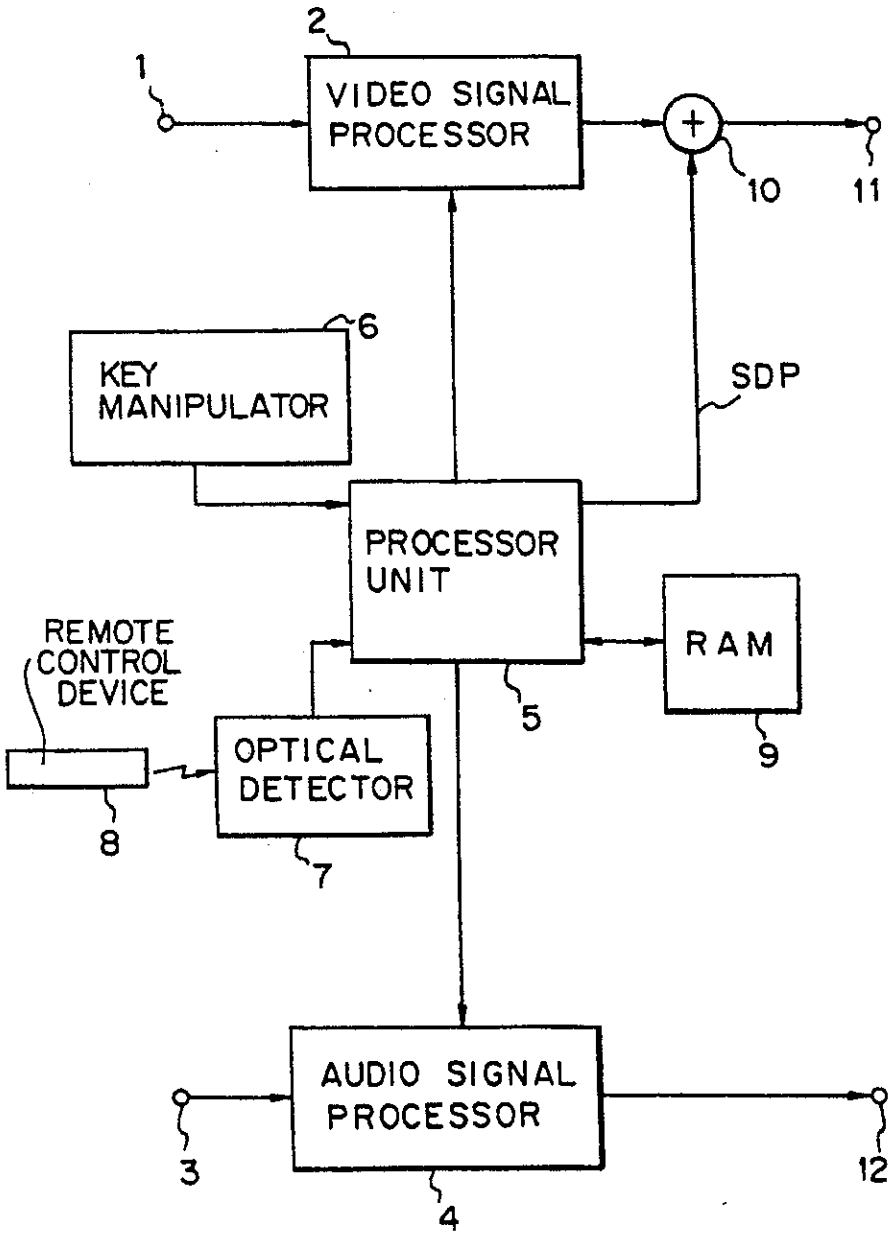

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Fig. 2

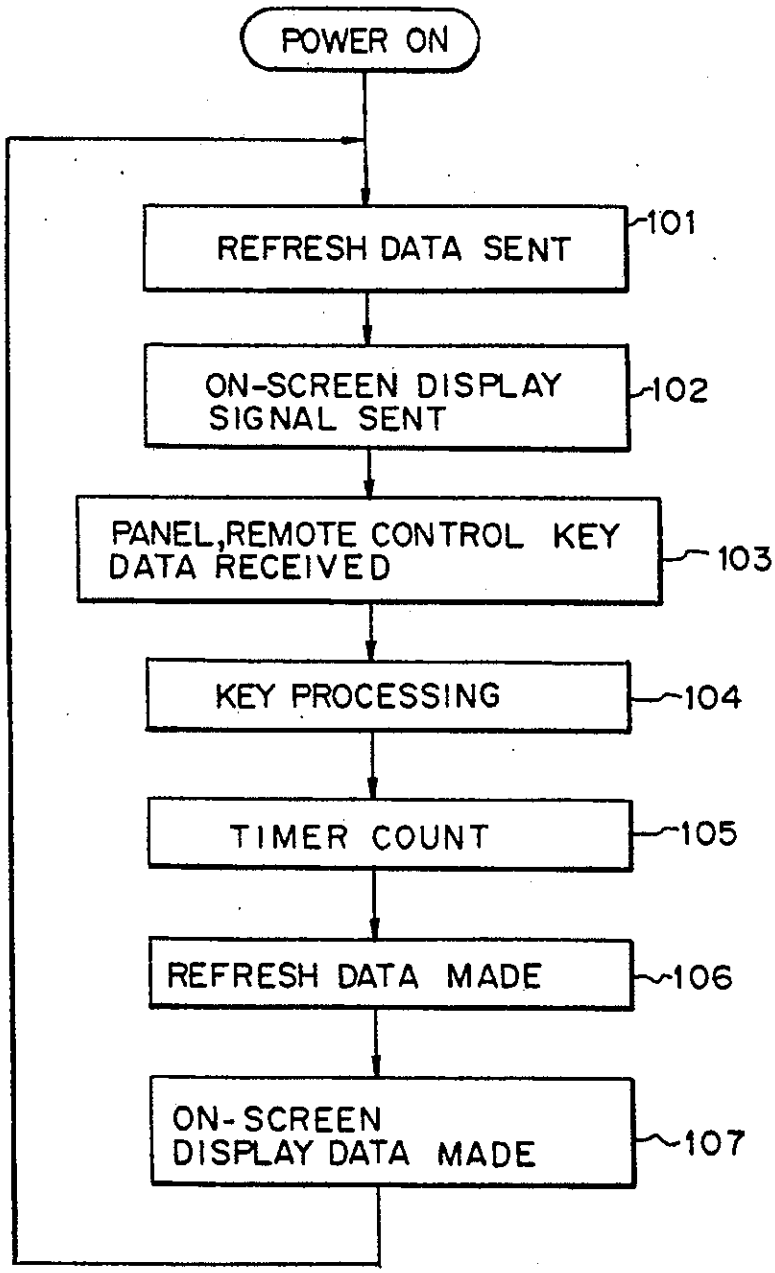

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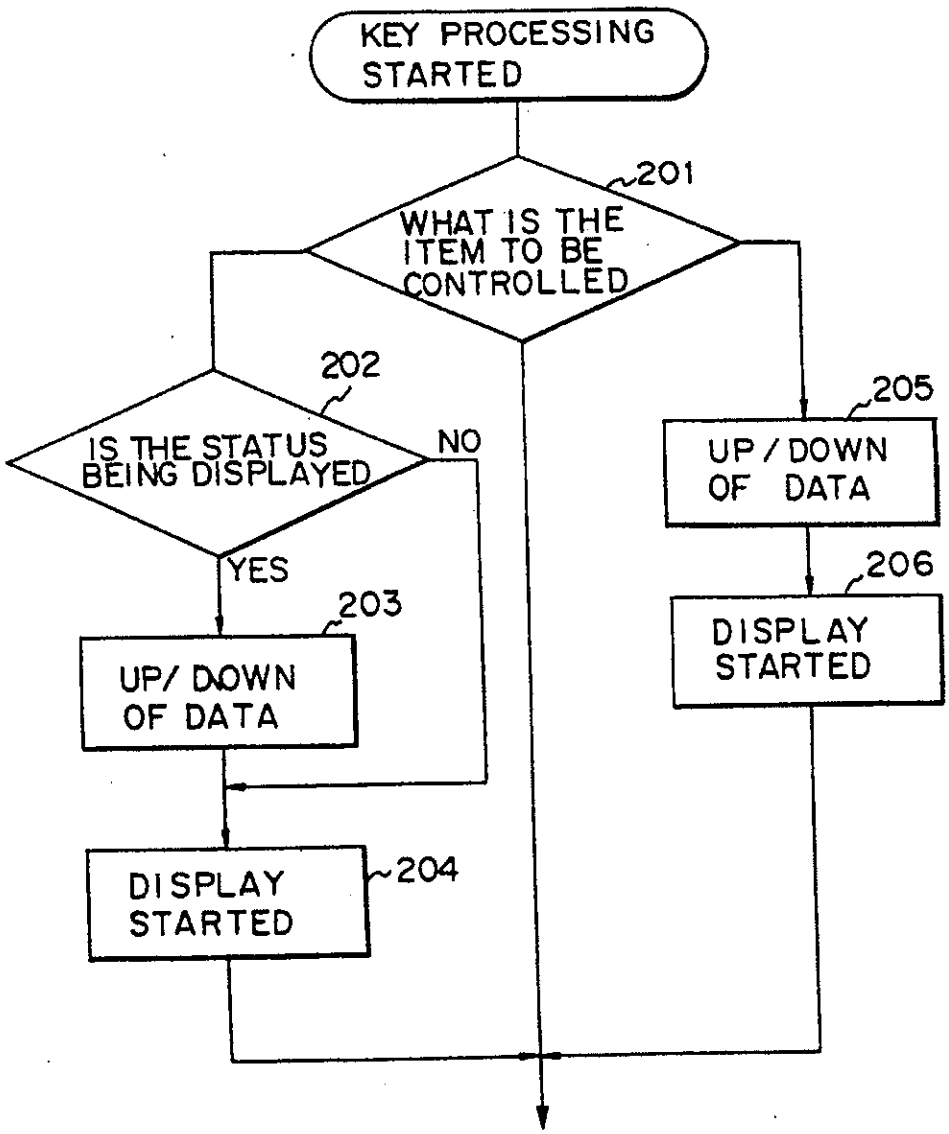
Fig. 3



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METHOD OF CONTROLLING FIRST ITEMS THAT REQUIRE PRIOR CRT DISPLAY AND SECOND ITEMS THAT REQUIRE NO PRIOR DISPLAY

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a method for displaying a controlled status and, more particularly, to an improvement of display on a screen effected upon adjustment of a CRT display.

2. Description of the Prior Art

A recent type of television receivers is configured to display on its screen the amount of a respective item to be adjusted when a user adjusts the volume, the tone, the hue, the brightness, and so forth. There are, in general, two types of on-screen display shown below.

The first type is such that a current analog value is first displayed on a screen in order to permit a user to select a desired analog value with reference to the current analog value through key manipulation, and a new analog value selected is displayed on the screen.

The second type is such that a new analog value selected by a user through key manipulation is directly displayed on a screen.

In order for a user to control an analog value for control of a CRT display such as a television receiver, he or she needs knowledge on the current status before the intended control for some of such items to be controlled, but need not know it for the other items.

Examples of items for which a user must know the current status, such as identification of the item, its current analog value, and so on, are: brightness, sharpness, phase, chroma, and so on, related to the image display status; and bass, balance, and so on, related to the audio quality.

For such items for which a user must know the current status, the first type on-screen display is necessary. That is, an analog value that has been set heretofore must be displayed before control manipulation.

Examples of items for which a user need not known the current status are: contrast, related to the condition of image display; and volume, related to the audio quality.

For such items for which a user need not know the current status, the second type on-screen display on a screen is desired. That is, it is sufficient that a new analog value selected by a user through key manipulation be directly displayed on the screen.

Existing television receivers, however, do not clearly distinguish the use of the above-mentioned types of on-screen display in accordance with the necessity of confirmation of the current status of a respective item to be controlled.

For example, when a user wants to control one of the items: brightness, sharpness, phase and chroma, the current analog value must be displayed on the screen before the control manipulation. Actually, however, this is not done so in some cases. Therefore, the existing television receivers are not always convenient for users.

OBJECT AND SUMMARY OF THE INVENTION

It is therefore an object of the invention to provide a method for displaying a controlled status, which clearly distinguishes the use of the types of on-screen display in accordance with the necessity of confirmation of the current status of a respective item to be controlled.

According to an aspect of the invention, there is provided a method for displaying a controlled status in a system including a manipulating key for adjusting a plurality of items to be controlled, a control unit coupled to the manipulating key for generating a control signal for adjustment, a signal processor responsive to the control signal for controlling a video signal or an audio signal, and a CRT display for simultaneously displaying a video signal from the signal processor and an adjusting value of the control signal on a screen, comprising the steps of:

receiving an instruction signal from the manipulating key and identifying that the item to be controlled is of a first type or a second type;

if the item to be controlled is identified to be of the first type, confirming that a current controlled value is being displayed on the display unit, and then permitting adjustment by the instruction signal; and

if the item to be controlled is identified to be of the second type, permitting adjustment by the instruction signal.

The above, and other, objects, features and advantage of the present invention will become readily apparent from the following detailed description thereof which is to be read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a circuit for discriminating a controlled status and for making an on-screen display signal which can be applied to the present invention;

FIG. 2 is flow chart showing operations of a processor unit; and

FIG. 3 is a flow chart showing operations of the processor unit.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An embodiment of the invention is explained below with reference to FIGS. 1 to 3. FIG. 1 shows an arrangement of a circuit for discriminating a controlled status and making an on-screen display signal, which can be applied to this invention. In the arrangement of FIG. 1, a video signal is fed to a video signal processor 2 through an input terminal 1, and an audio signal is fed to an audio signal processor 4 through an input terminal 3. The video signal processor 2 and the audio signal processor 4 are controlled by a processor unit 5.

To the processor unit 5 are coupled a key manipulator 6, an optical detector 7, a RAM 9 and so on. When one of various keys provided in the key manipulator 6 is manipulated, a signal corresponding to the key manipulated is made in the key manipulator 6, and it is sent to the processor unit 5. The optical detector 7 receives and decodes a remote control signal from a remote control commander 8, and sends an obtained signal to the processor unit 5.

In response to the signal from the key manipulator 6 or the signal from the optical detector 7, the processor unit 5 identifies the item to be controlled, such as brightness, sharpness and volume, and the control level, i.e., the analog value, for the item to be controlled.

As will be described later, the processor unit 5 classifies the control items into a first control class and a

second control class, and produces various kinds of control signals, screen display signals SDP, and so on, which are associated with respective classes. Items in the first control class are those for which a user needs knowledge on the current status, that is, the mode, the analog value, and so on, before he or she controls the analog value. Items in the second class are those for which the user need not know the current status before he or she controls the analog value.

If an item to be controlled belongs to the first control class, the processor unit **5** produces character data on identification of the item and its current analog value in the form of an on-screen display signal SDP, and gives the on-screen display signal SDP to an adder **10**. The adder **10** superimposes the on-screen display signal SDP supplied from the processor unit **5** on the video signal supplied from the video signal processor **2**. A signal obtained by superimposing the on-screen display signal **5** on the video signal is output through a terminal **11** to a CRT display (not shown) and displayed thereon.

After this, in response to the signal indicative of a controlled item and its analog value, which is supplied from the key manipulator **6** or the remote control commander **8** through the optical detector **7**, the processor unit **5** produces character data in the form of the on-screen display signal SDP, which indicates the item to be controlled and its new analog value, i.e., the level of the status after adjustment, and supplies the on-screen display signal SDP to the adder **10**. Also in response to the signal indicating the item to be controlled and its analog value, which is supplied from the key manipulator **6** or the remote control commander **8** via the optical detector **7**, the processor unit **5** produces various kinds of control signals. These control signals are fed to the video signal processor **2**, the audio signal processor **4**, and so on.

The video signal processor **2** controls the video signal in response to the control signals from the processor unit **5**. The video signal after the control is fed to the adder **10**. The adder **10** superimposes to the video signal from the video signal processor **2** on the on-screen display signal SDP, which is supplied from the processor unit **5** and consists of character data indicating the item to be controlled and its newly set analog value. A signal obtained by superimposing the on-screen display signal SDP on the video signal is output through the output terminal **11** to a CRT display (not shown). The audio signal processor **4** controls the audio signal in response to the control signals supplied from the processor unit **5**. The controlled audio signal is output through a terminal **12** to a speaker (not shown).

If the item to be controlled belongs to the second control class, the processor unit **5** produces various kinds of control signals in response to the signal indicating the item to be controlled and its analog value, which is supplied from the key manipulator **6** or the remote control commander **8** via the optical detector **7**. These control signals are fed to the video signal processor **2**, the audio signal processor **4**, and so on. The video signal processor **2** controls the video signal in response to the control signals from the processor unit **5**, and the controlled video signal is fed to the adder **10**.

After this, in response to the signal indicating the item to be controlled and its analog value, which is supplied from the key manipulator **6** or the remote control commander **8** through the optical detector **7**, the processor unit **5** produces character data in the form of the on-screen display signal SDP, which indicates the item to be controlled and its new analog value, i.e., the level of the status after adjustment, and supplies the on-screen display signal SDP to the adder **10**.

The adder **10** superimposes to the video signal from the video signal processor **2** on the on-screen display signal SDP, which is supplied from the processor unit **5** and consists of character data indicating the item to be controlled and its newly set analog value. A signal obtained by superimposing the on-screen display signal SDP on the video signal is output through the output terminal **11** to a CRT display (not shown).

The processor unit **5** performs, once a vertical scanning period, its operations such as receipt of the signal from the key manipulator **6** or the optical detector **7**, control of the video signal processor **2** and the audio signal processor **4**, output of the on-screen display signal SDP, on-screen display of the item to be controlled and its analog value, and so on. Control by the processor unit **5** is explained below with reference to FIG. **2**.

In a condition where the power is supplied, in step **101**, refresh data originally set in a slave CPU is transferred from a master CPU which is the processor unit **5** in this embodiment. Control then passes to step **102**.

In step **102**, the on-screen display signal SDP made on the basis of character data such as letters, symbols, figures, etc. to be displayed on the screen is sent from the processor unit **5** to the adder **10**. Control then moves to step **103**.

In step **103**, a signal made by manipulation in the key manipulator **6** or the optical detector **7** is received. Control then passes to step **104**.

In step **104**, an item to be controlled and its analog value are defined on the basis of the signal supplied from the key manipulator **6** or the optical detector **7**. Control then moves to step **105**.

In step **105**, time is counted. When a predetermined time has passed, control passes to step **106**.

In step **106**, refresh data is made. If control data for each item to be controlled, i.e. the analog value, for each item to be controlled has been controlled in the upward or downward direction by the key processing in step **104**, new data on the analog value is set for each item to be controlled. Control then goes to step **107**. In step **107**, the on-screen display signal SDP is produced on the basis of character data such as letters, symbols, figures, and so on, to be displayed on the screen. After this, control returns to step **101**.

With reference to FIG. **3**, next explanation is directed to operations of the processor unit **5**, such as receipt of a signal from the key manipulator **6** or the optical detector **7**, control of the video signal processor **2** and the audio signal processor **4**, output of the on-screen display signal SDP, on-screen display of an item to be controlled and its analog value, and so on.

In step **201**, an item to be controlled and its analog value are determined on the basis of a signal supplied from the key manipulator **6** or the optical detector **7**. In this step **201**, the item to be controlled is classified into one of the following two classes:

(1) First control class:

(1-*a*) Items directly related to the screen status and requiring user's confirmation of the current level of the analog value. Pertinent items are: brightness, aperture, sharpness, phase, chroma, and so forth. Note that the term "phase" indicates the tone of a color while the term "chroma" represents the depth of a color.

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(1-*b*) Items related to the audio status and requiring display of the current mode for confirmation. Pertinent examples are: bass, treble, balance, and so forth.

(2) Second control class:

This contains items to be controlled for which a user himself determines in an absolute level whether the analog value is adequate or not and for which the user need not confirm the current analog value before he controls it. Pertinent examples are: contrast, volume, and so forth.

Only when an item is determined to belong to the first control class in step **201**, characters such as letters, symbols, figures, etc. indicating an item to be controlled and its current analog value are displayed on the screen. After this, control moves to step **202**. If the item is determined to belong to the second class, control goes to step **205**. If nothing is done in step **201**, control moves to the next process.

In step **202**, it is determined whether characters such as letters, symbols, figures, etc. indicating an item to be controlled and its current analog value are being displayed on the screen. If they are, control moves to step **203**, and if not, control moves to step **204**. In step **203**, a signal for controlling the analog value is supplied to the processor unit **5** from the key manipulator **6** or the remote control commander **8** through the optical detector **7**. In this step **203**, on the basis of a control signal output from the processor unit **5**, the video signal processor **2** and/or the audio signal processor **4** control(s) the video signal and/or the audio signal in response to an analog value selected for an intended item to be controlled. At the same time, a new analog value after the control is produced in the form of the on-screen display signal SDP. Control then passes to step **204**.

In step **204**, characters indicating the item to be controlled and its analog value after the control are displayed on the screen on the basis of the on-screen display signal SDP. The display on the screen lasts for a predetermined time, for example, three seconds. Control then passes to the next process.

In step **205**, on the basis of a control signal output from the processor unit **5**, the video signal processor **2** and/or the audio signal processor **4** control(s) the video signal and/or the audio signal in response to an analog value selected for an intended item to be controlled. At the same time, an analog value after the control is produced in the form of the on-screen display signal SDP. Control then passes to step **206**. In step **206**, characters indicating the item to be controlled and its new analog value after the control are displayed on the screen on the basis of the on-screen display signal SDP. The display on the screen lasts for a predetermined time, for example, three seconds. Control then moves to the next process.

According to the embodiment, items to be controlled are classified into the first control class, for which a user needs confirmation of the current status, i.e., the current mode, its analog value, and so on, before control of the analog value, and the second control class, for which a user need not confirm the present status. If an item to be controlled belongs to the first control class, its identification and its analog value are once displayed; then a new controlled analog value obtained by controlling the video signal and/or the audio signal is displayed on the screen. If the item belongs to the second control class, the video signal and/or the audio signal is (are) processed immediately, and a new analog value after the control is displayed on the screen. Therefore, different types of on-screen display can be properly used in accordance with the nature of a respective item to be controlled, i.e., whether confirmation of the current status of the item is necessary or not. The television receiver is thus convenient for a user.

The embodiment has been described as being applied to a television receiver; however, the invention may also be used in any desired display means other than television receivers.

Having described a specific preferred embodiment of the present invention with reference to the accompanying drawings, it is to be understood that the invention is not limited to that precise embodiment, and that various changes and modifications may be effected therein by one skilled in the art without departing from the scope or the spirit of the invention as defined in the appended claims.

What is claimed is:

1. A method for displaying a controlled status in a system including manipulation means for adjusting a plurality of items to be controlled, control means coupled to said manipulation means for generating a control signal for adjustment, signal processing means responsive to said control signal for controlling a video signal or an audio signal, and display means for simultaneously displaying a video signal from said signal processing means and an adjusting value of said control signal on a screen, comprising the steps of:

receiving an instruction signal relating to an item of said plurality of items which is to be controlled from said manipulation means and, in response to said instruction signal:

identifying the item to be controlled; and

classifying said item to be controlled as being of a first type, for which a user needs confirmation of current status, or a second type, for which a user need not confirm the current status; and then,

if said item to be controlled is classified as being of said first type, confirming that a current controlled value is displayed on said display means, and thereafter permitting adjustment by said instruction signal to produce a new controlled value and displaying the new controlled value on said display means; and

if said item to be controlled is classified as being of said second type, permitting adjustment by said instruction signal to produce a new controlled value without prior display of a current controlled value and then displaying the new controlled value on said display means.

2. A method for displaying a controlled status according to claim **1** wherein said item to be controlled is related to a television monitor incorporating a CRT display.

3. A method for displaying a controlled status according to claim **2** wherein said item to be controlled which is classified as being of said first type is one of brightness, aperture, sharpness, phase, chroma, bass, treble, and balance, and said item to be controlled which is classified as being of said second type is one of contrast and volume.

* * * * *

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EXHIBIT L

EXHIBIT L
PAGE 339

US005212553A

United States Patent [19]

Maruoka

[11] Patent Number: 5,212,553

[45] Date of Patent: May 18, 1993

[54] **TELEVISION RECEIVER WITH SELECTIVE MENU DISPLAY**

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[73] Assignee: **Sony Corporation**, Tokyo, Japan

[21] Appl. No.: **744,248**

[22] Filed: **Aug. 13, 1991**

[30] **Foreign Application Priority Data**

Sep. 4, 1990 [JP] Japan 2-233664

[51] **Int. Cl.**[5] **H04N 9/74; H04N 5/44**

[52] **U.S. Cl.** **358/188**; 358/22; 358/183

[58] **Field of Search** 358/22, 183, 188

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Primary Examiner—John K. Peng
Assistant Examiner—John W. Miller
Attorney, Agent, or Firm—Lewis H. Eslinger; Jay H. Maioli

[57] **ABSTRACT**

A television receiver with a menu display function has a BS tuner for producing a video signal and a sound signal from a received television signal that is broadcast from a satellite. The television receiver has a microcomputer for adding a menu display signal to the video signal so that menu information can be displayed on a display unit. The menu display signal represents a plurality of menu items in each of selectable menu modes, and the menu items are selectively erasable from the display unit.

4 Claims, 4 Drawing Sheets

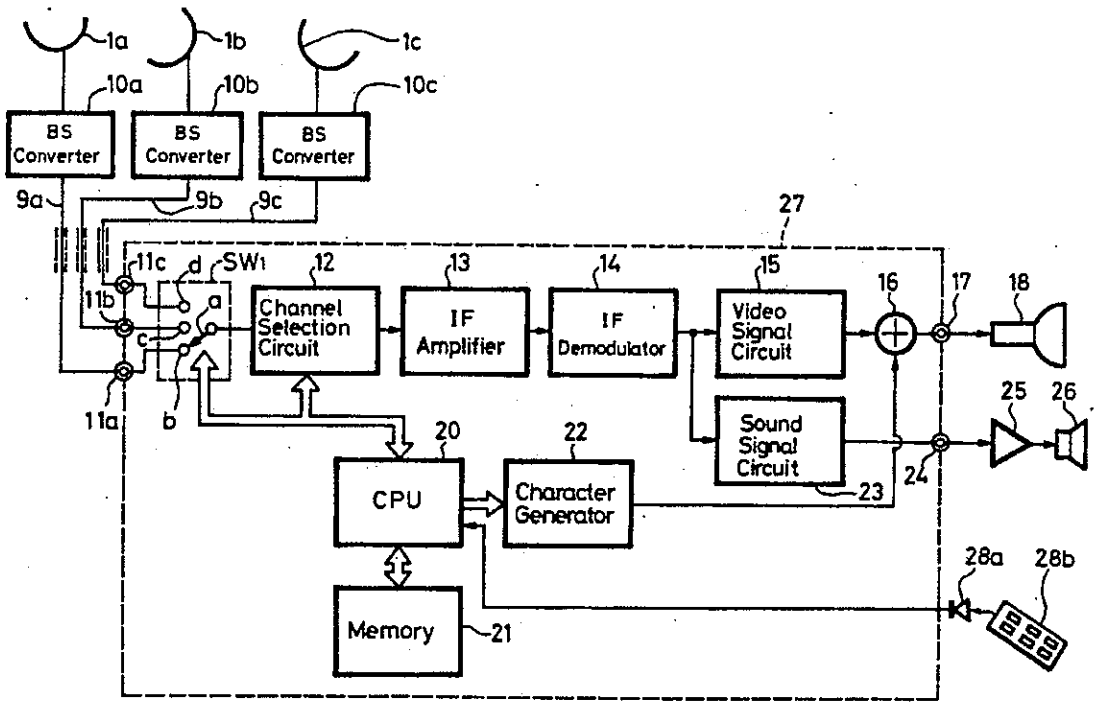

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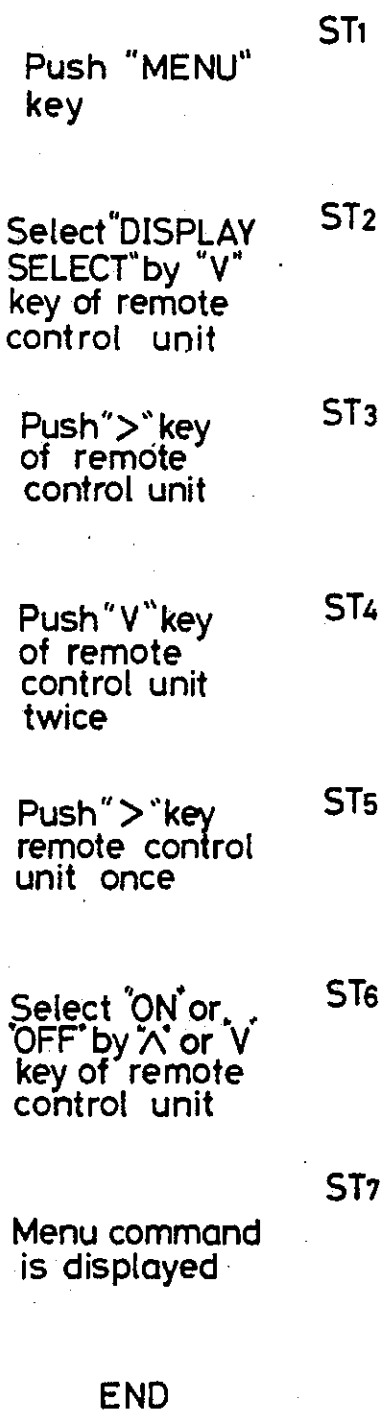
FIG. 1



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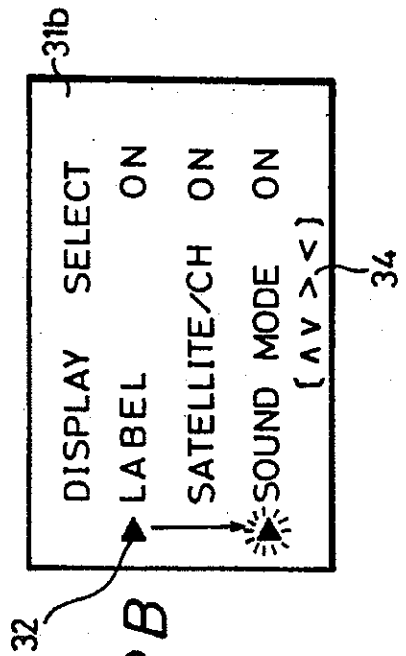

FIG. 2B

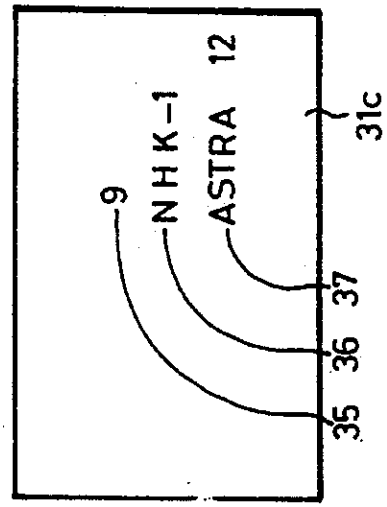

FIG. 2D

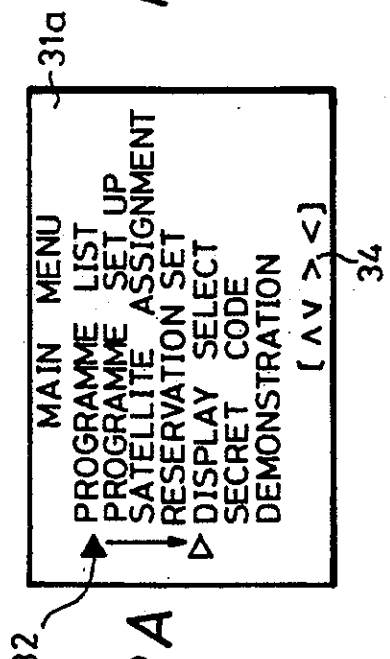

FIG. 2A

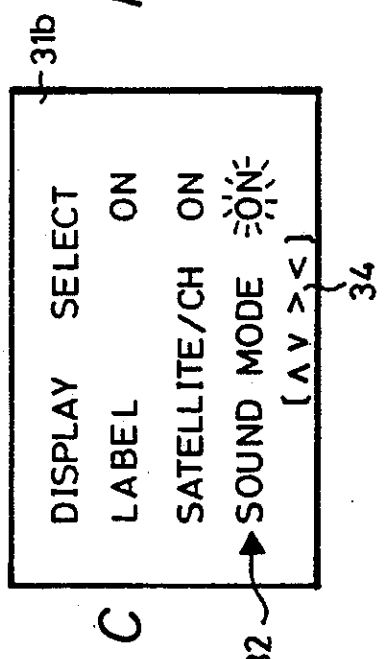

FIG. 2C

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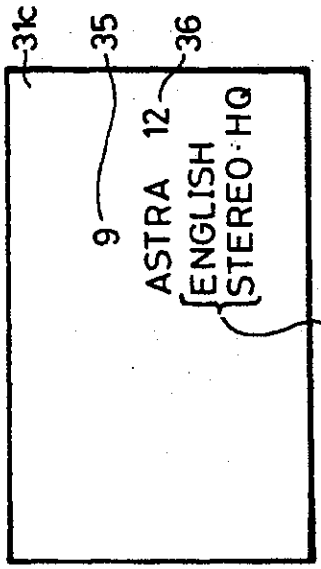

FIG. 3B

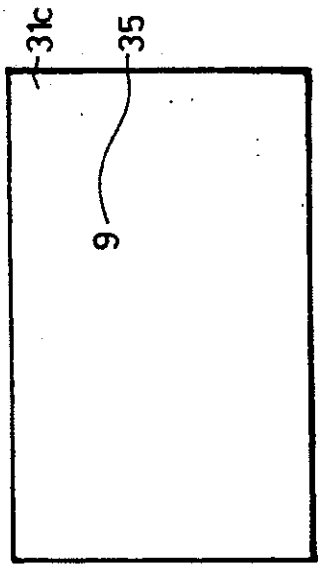

FIG. 3D

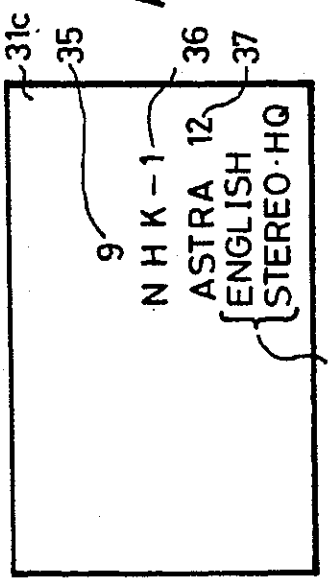

FIG. 3A

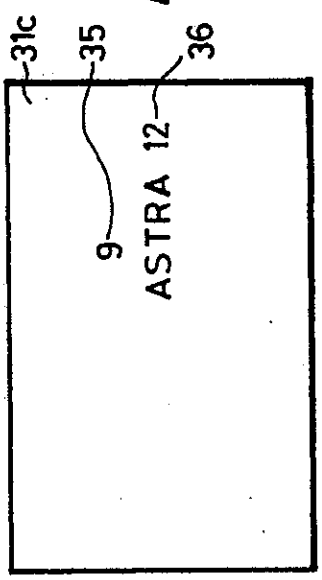

FIG. 3C

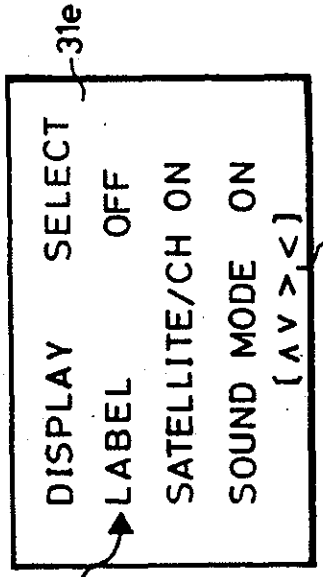

FIG. 3E

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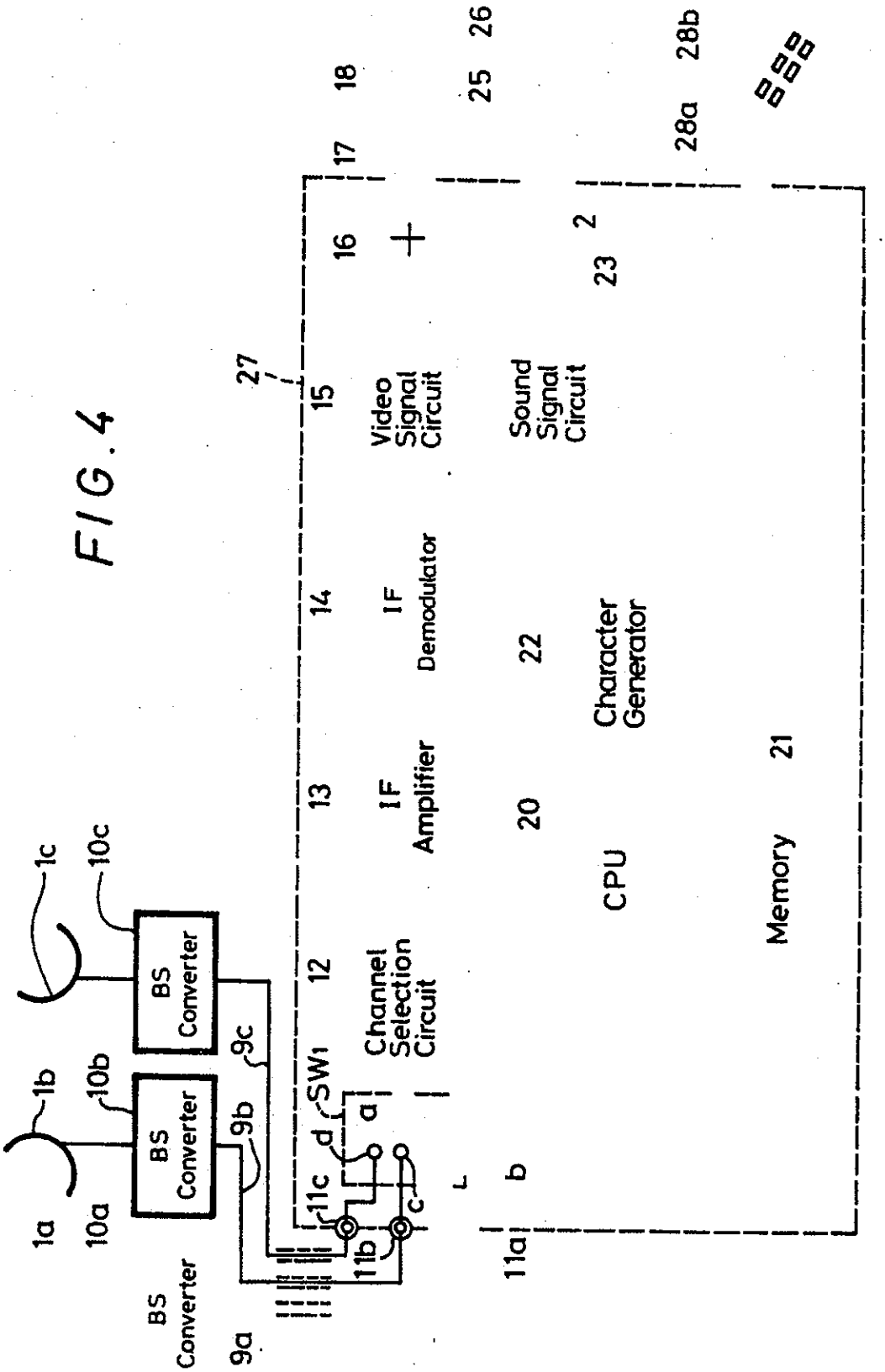

FIG. 4

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TELEVISION RECEIVER WITH SELECTIVE MENU DISPLAY

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a television receiver having a menu display function with selective display of menu items.

2. Description of the Prior Art

Television receivers, BS tuners, and some other electronic devices that have recently become available have a menu display function for making themselves easier to handle as well as displaying high-quality images. The menu function enables CRT display units or the like to display menu items for facilitating various settings which would otherwise be rather complex for the user to adjust and establish. Those electronic devices, such as television receivers, which are capable of receiving high-definition broadcasts, and other broadcasts and communications via communication satellites that have newly been launched, however, require more and more difficult settings which may not easily be entered by ordinary users.

The conventional electronic devices which have a menu function display a plurality of standard menu items when in the menu display mode. The displayed standard menu items are permanently established when the electronic devices are designed, and some of the standard menu items may not be necessary for some users.

On the conventional electronic devices, it is possible for the user to turn on or off the entire set of standard menu items. However, the user cannot select a desired one or ones of the standard menu items and then turn on and off the selected standard menu item or items.

When the user wishes to select one of the standard menu items displayed on the display unit, therefore, the user may find the displayed menu information too awkward to deal with.

OBJECTS AND SUMMARY OF THE INVENTION

In view of the aforesaid problems of the conventional television receivers and other electronic devices with a menu function, it is an object of the present invention to provide a television receiver with a menu function or picture in picture function, which television receiver allows the user to select only the menu item or items he needs while leaving other undesirable standard menu items undisplayed.

According to the present invention, there is provided a television receiver comprising circuit means for producing a video signal and a sound signal from a received television signal, display means for displaying an image based on the video signal, and control means for controlling the circuit means to produce the video signal, the control means comprising means for adding to the video signal a menu display signal representing a plurality of selectively erasable menu items.

The control means comprises a character generator for generating characters representing the selectively erasable menu items, and a control unit for controlling the character generator.

The above and other objects, features, and advantages of the present invention will become apparent from the following description of an illustrative embodiment thereof to be read in conjunction with the accompanying drawings, in which like reference numerals represent the same or similar objects.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a flowchart of an operation sequence of a television receiver according to the present invention;

FIGS. 2A through 2D are views showing menu items displayed according to the operation sequence shown in FIG. 1;

FIGS. 3A through 3E are views showing the manner in which menu commands are displayed by the television receiver according to the present invention; and

FIG. 4 is a block diagram of the television receiver according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The principles of the present invention are particularly useful when embodied in a television receiver with a BS tuner and BS converters for receiving satellite broadcasts, as shown in FIGS. 1 through 4. First, the arrangement of the television receiver will be described below with reference to FIG. 4.

As shown in FIG. 4, the television receiver includes BS antennas 1*a*, 1*b*, 1*c* in the form of parabolic or planar antennas for receiving dextrorotatory or levorotatory polarized radio waves from a plurality of different satellites. Each of the BS antennas 1*a*, 1*b*, 1*c* has a parabolic reflector, for example, for reflecting a received radio wave in an SHF band, a primary radiating element for receiving the reflected radio wave, and a circular-to-linear polarization converter for converting the dextrorotatory or levorotatory polarized wave into a linearly polarized wave. An RF output in the SHF band from the circular-to-linear polarization converter is supplied to the BS converter 10*a*, for example. In the BS converter 10*a*, the supplied RF signal is amplified by an RF amplifier, and the amplified signal is supplied to a mixer through a bandpass filter (BPF). In the mixer, the signal is mixed with a signal from a local oscillator, producing a BS-IF signal in a 1-GHz band, for example. The BS-IF signal from the mixer is then amplified by an intermediate-frequency amplifier, from which the amplified signal is supplied to an output terminal of the BS converter 10*a*. To the output terminal of the BS converter 10*a*, there is connected one end of a coaxial cable 9*a*, the other end of which is connected to an input terminal 11*a* of a BS tuner 27.

While the BS converter 10*a* has been described above, the other BS converters 10*b*, 10*c* are of the same construction as that of the BS converter 10*a*.

The BS-IF signals from the BS converters 10*a*, 10*b*, 10*c* are supplied respectively to the input terminals 11*a*, 11*b*, 11*c* of the BS tuner 27. The BS-IF signals are applied to respective fixed contacts b, c, d of an IF terminal selector switch SW1 whose movable contact a is connected to a channel selection circuit 12. The BS-IF signal which is selected by the IF terminal selector switch SW1 is therefore applied to the channel selection circuit 12, by which a desired channel CH is selected from the BS-IF signal. The channel selection circuit 12 includes an RF amplifier, a mixer, and a local oscillator. The mixer and the local oscillator serve to convert the BS-IF signal into an intermediate-frequency signal. The frequency produced by the local oscillator is variable depending on the selected channel.

The intermediate-frequency signal is then supplied from the channel selection circuit **12** to an intermediate-frequency amplifier **13**. The intermediate-frequency amplifier **13** has an intermediate-frequency filter for removing unwanted signals other than the intermediate-frequency signal in the selected channel. In the intermediate-frequency amplifier **13**, the intermediate-frequency signal is amplified, and passed through an AGC circuit to an amplitude limiter in which it is adjusted to a constant signal level, removing AM noise. Thereafter, the intermediate-frequency signal is frequency-demodulated by a frequency demodulator **14**.

The frequency-demodulated signal from the frequency demodulator **14** is supplied to a video signal circuit **15** and a sound signal circuit **23**. In the video signal circuit **15**, a video signal is extracted from the baseband of the frequency-demodulated signal. The video signal is then supplied through an output terminal **17** to a display unit **18** such as a CRT or the like for displaying an image. In the sound signal circuit **23**, a PCM sound signal transmitted by way of differential phase shift keying in the frequency-demodulated signal is demodulated into a sound signal. The sound signal is then supplied through an output terminal **24** and a driver amplifier **25** to a loudspeaker **26**, from which the sound is radiated.

The BS tuner **27** has a control unit **20** such as a microcomputer (CPU) for controlling a character generator (CG) **22** which generates messages to be displayed in the form of characters. For example, the control unit **20** controls the CG **22** to supply a generated message to one of three primary output terminals, R (red), G (green), B (blue), of the video signal circuit **15**, e.g., the output terminal G, so that the message is displayed in G color on the display unit **18**. The CPU **20** is connected to a photosensor **28***a* for detecting commands transmitted from a remote control unit **28***b*, so that the CPU **20** can receive command data from the remote control unit **28***b*. The CPU **20** also serves to control the channel selection circuit **12**. A memory **21** such as a ROM, RAM, or the like is connected to the CPU **20**.

Operation of the television receiver shown in FIG. **1** will be described with reference to FIGS. **1**, **2A** through **2D**, and **3A** through **3E**.

FIG. **1** shows an operation sequence for turning off a sound mode. FIGS. **2A** through **2E** show displayed menu items by way of example. In FIG. **1**, after the power supply of the television receiver is turned on, a menu key on the remote control unit **28***b* is pushed to display a main menu on the display unit **18** in a first step **ST1**. At this time, a main menu **31***a* is displayed on the display unit **18** as shown in FIG. **2A**. The main menu **31***a* displays seven menu modes. The first menu mode represents "PROGRAM LIST", the second menu mode "PROGRAM SETUP", the third menu mode "SATELLITE ASSIGNMENT", the fourth menu mode "RESERVATION SET", the fifth menu mode "DISPLAY SELECT", the sixth menu mode "SECRET CODE", and the seventh menu mode "DEMONSTRATION".

By way of example, the user pushes a "V" key on the remote control unit **28***b*, which is represented by a displayed symbol **34**, to move a cursor **32** in the main menu to the fifth menu mode, "DISPLAY SELECT", in a second step **ST2**. Then, with the cursor **32** at the fifth menu item, a ">" key (enter key) on the remote control unit **28***b* is pushed in a third step **ST3**, whereupon the display unit **18** displays display select menu information **31***b* as shown in FIG. **2B**. The display select menu information **31***b* includes items such as "LABEL", "SATELLITE/CHANNEL", and "SOUND MODE". If the television receiver is designed for use in Europe, for example, provision may be made for the user to store six characters, for example, in the memory after having purchased the television receiver. The item "LABEL" indicates the stored characters, and is used to select a predetermined channel. The item "SATELLITE/CHANNEL" is used to select a satellite type and channel number. The item "SOUND MODE" is used to select a language such as English, French, or the like, and a quality of reproduced sound. These items are displayed in "ON" state on the display unit **18**. In a fourth step **ST4**, the "V" key on the remote control unit **28***b* is pushed twice to move the cursor **32** to the item "SOUND MODE", where the cursor **32** blinks.

Then, the ">" key on the remote control unit **28***b* is pushed once in a fifth step **ST5**. The cursor **32** no longer blinks, but the displayed item "ON" on the right side of the item "SOUND MODE" starts to blink. If "SOUND MODE" is to be canceled, then "ON" is changed to "OFF" using the "L" or "V" key on the remote control unit **28***b*. If "SOUND MODE" is not to be canceled, then "ON" remains unchanged. The items "ON" and "OFF" are toggle items. When "SOUND MODE" is canceled, then a selected standard menu command **31***c* is displayed with "SOUND MODE" erased, as shown in FIG. **2D**, in a seventh step **ST7**. The number "9" displayed in the standard menu command **31***c* represents a program number **35**, the item "NHK-1" a label **36**, and the item "ASTRA 12" a satellite type and channel number **37**.

The user stores the number of a preferred channel in the program number **35**, and the program number **35** is used for the user to have a clue in receiving the channel. If all the items "LABEL", "SATELLITE/CHANNEL", "SOUND MODE" in the menu information shown in FIG. **2B** are "ON", then the displayed standard menu command **31***c* becomes displayed standard men command **31***c* as shown in FIG. **3A**, displaying all the program number **35**, the label **36**, the satellite type and channel number **37**, and also a sound mode **38**. Conversely, if all the items "LABEL", "SATELLITE/CHANNEL", "SOUND MODE" in the menu information shown in FIG. **2B** are "OFF", then only the program number **35** is displayed as shown in FIG. **3D**, erasing the label **36**, the satellite type and channel number **37**, and the sound mode **38**.

Other menu commands will be described below with reference to FIGS. **3B**, **3C**, and **3E**. If the label is to be erased, the cursor is moved to "LABEL" as shown in FIG. **3E**. Then, the ">" key on the remote control unit **28***b* is pushed to blink "ON" on the right of "LABEL", and then the "A" key on the remote control unit **28***b* is pushed to select "OFF", whereupon a menu command with the label **36** erased is displayed as shown in FIG. **3B**. FIG. **3C** shows a menu command with the label and the sound mode erased.

Since one or more of the displayed menu items can be selected and selectively be displayed and erased. Therefore, only those menu items which are used to change channels, for example, can be selected and displayed for a simplified displayed menu command. The displayed menu command is easy for the user to see and deal with because unwanted menu items may be omitted.

While the menu mode "DISPLAY SELECT" has been described above, the other menu modes such as

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"SATELLITE ASSIGNMENT" may similarly be selected and processed.

Having described a preferred embodiment of the invention with reference to the accompanying drawings, it is to be understood that the invention is not limited to that precise embodiment and that various changes and modifications can be effected by one skilled in the art without departing from the spirit or scope of the invention as defined in the appended claims.

What is claimed is:

1. A television receiver comprising:

circuit means for receiving a television signal and producing a video signal and a sound signal from said received television signal;

display means for displaying an image based on said video signal; and

control means for controlling said circuit means, said control means comprising means for adding to said video signal a menu display signal representing a plurality of menu items and for selectively deleting said items under the direction of a user of the apparatus, whereby all or only selected ones of said menu items can be displayed on said displayed means.

2. A television receiver according to claim 1 wherein said menu items include menu items representing a television channel and a sound mode.

3. A television receiver according to claim 1 wherein said circuit means includes a BS receiver for receiving said television signal broadcast from satellite.

4. A television receiver according to claim 1 wherein said control means comprises a character generator for generating characters representing said menu items and said control means controls said character generator.

* * * * *

EXHIBIT 2
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EXHIBIT M

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US005168362A

United States Patent [19]

Yoshida

[11] Patent Number: 5,168,362

[45] Date of Patent: Dec. 1, 1992

[54] **APPARATUS FOR DISPLAYING STANDARD ASPECT RATIO TELEVISION SIGNAL ON WIDE ASPECT RATIO DISPLAY SCREEN**

[75] Inventor: **Chisato Yoshida**, Saitama, Japan

[73] Assignee: **Sony Corporation**, Tokyo, Japan

[21] Appl. No.: **691,817**

[22] Filed: **Apr. 26, 1991**

[30] **Foreign Application Priority Data**

May 1, 1990 [JP] Japan 2-111739

[51] **Int. Cl.**[5] **H04N 5/16**; H04N 5/18

[52] **U.S. Cl.** **358/171**; 358/172; 358/34; 358/140

[58] **Field of Search** 358/230, 140, 11, 12, 358/141, 142, 22, 183, 171–174, 176, 178, 168–169, 188, 180, 181, 34

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4,984,081	1/1991	Miyoshi	358/140

Primary Examiner—James J. Groody
Assistant Examiner—Michael H. Lee
Attorney, Agent, or Firm—Lewis H. Eslinger; Jay H. Maioli

[57] **ABSTRACT**

An image display apparatus includes an automatic pedestal processing circuit for detecting the minimum signal level of the input video signal for controlling the signal level of the video signal on the basis of the results of the detection. A control section is provided for activating the automatic pedestal processing circuit during the effective display period for the input video signals to prevent malfunction of the automatic pedestal processing section and to display an image with superior picture quality.

6 Claims, 10 Drawing Sheets

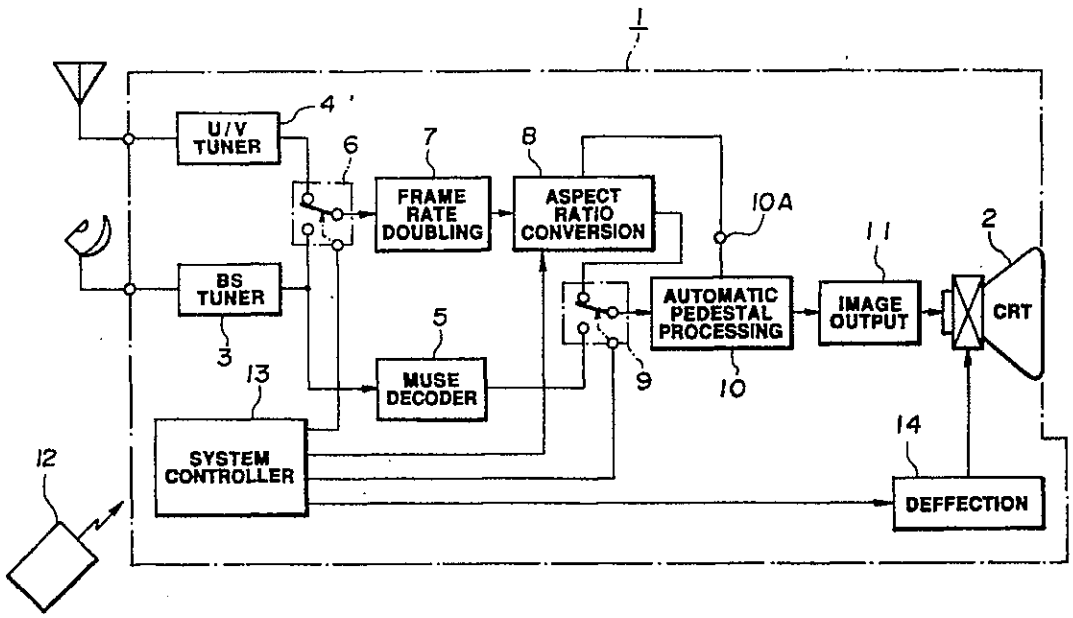

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FIG.1

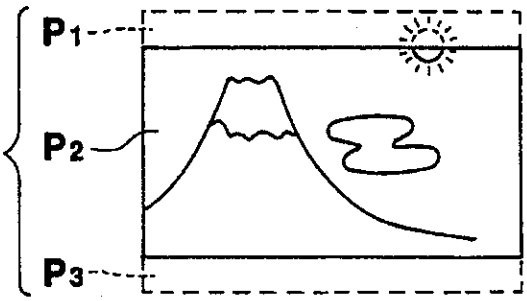


FIG.2

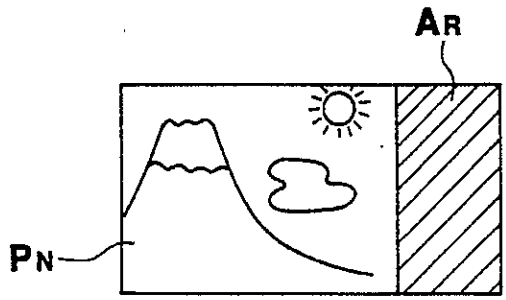


FIG.3

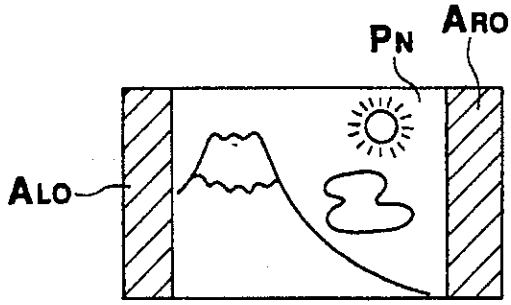
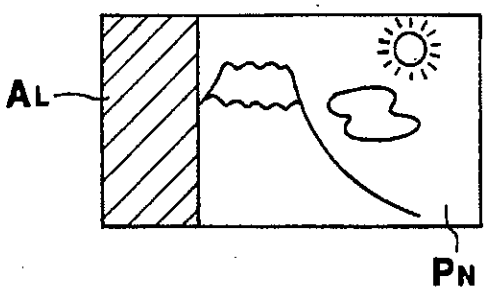


FIG.4



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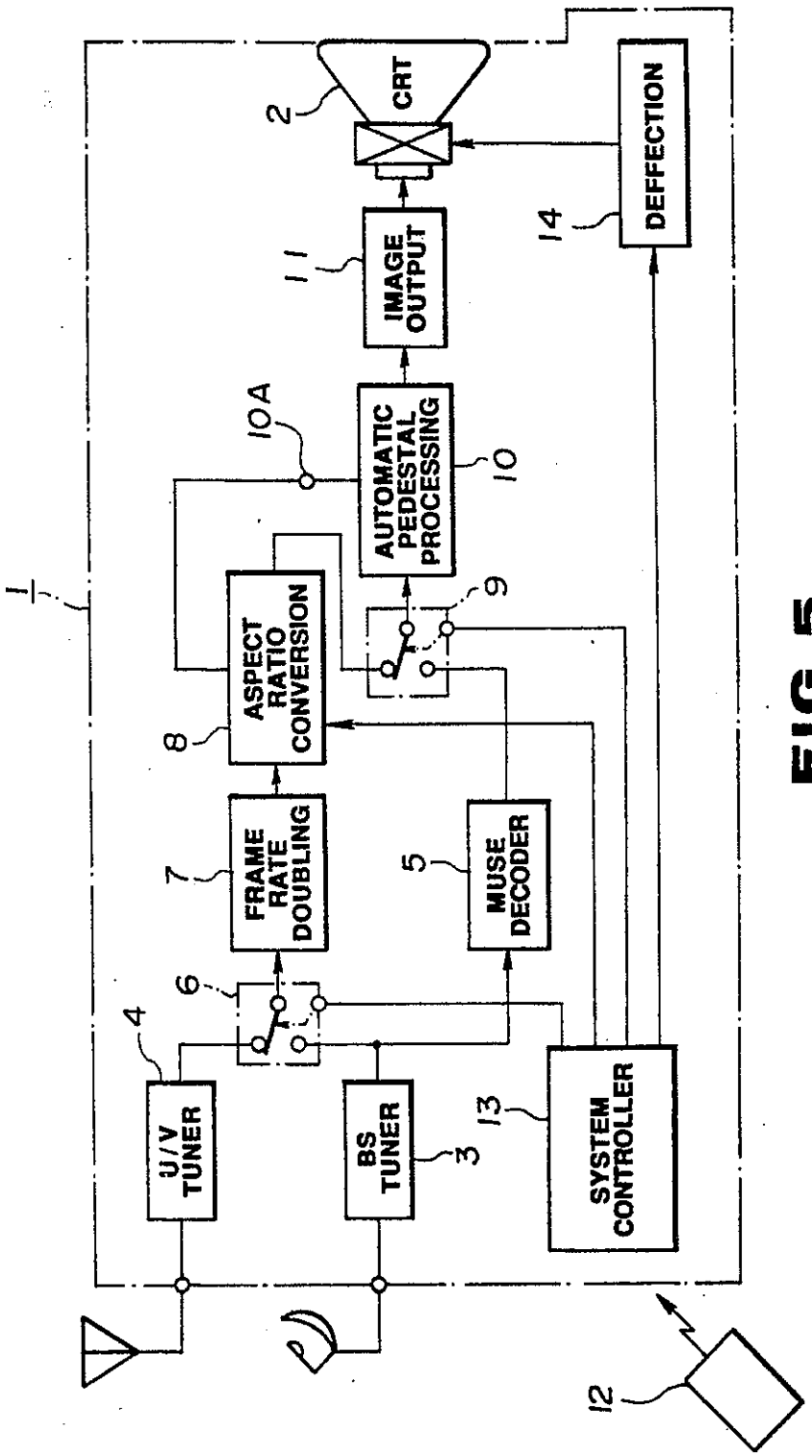

FIG. 5

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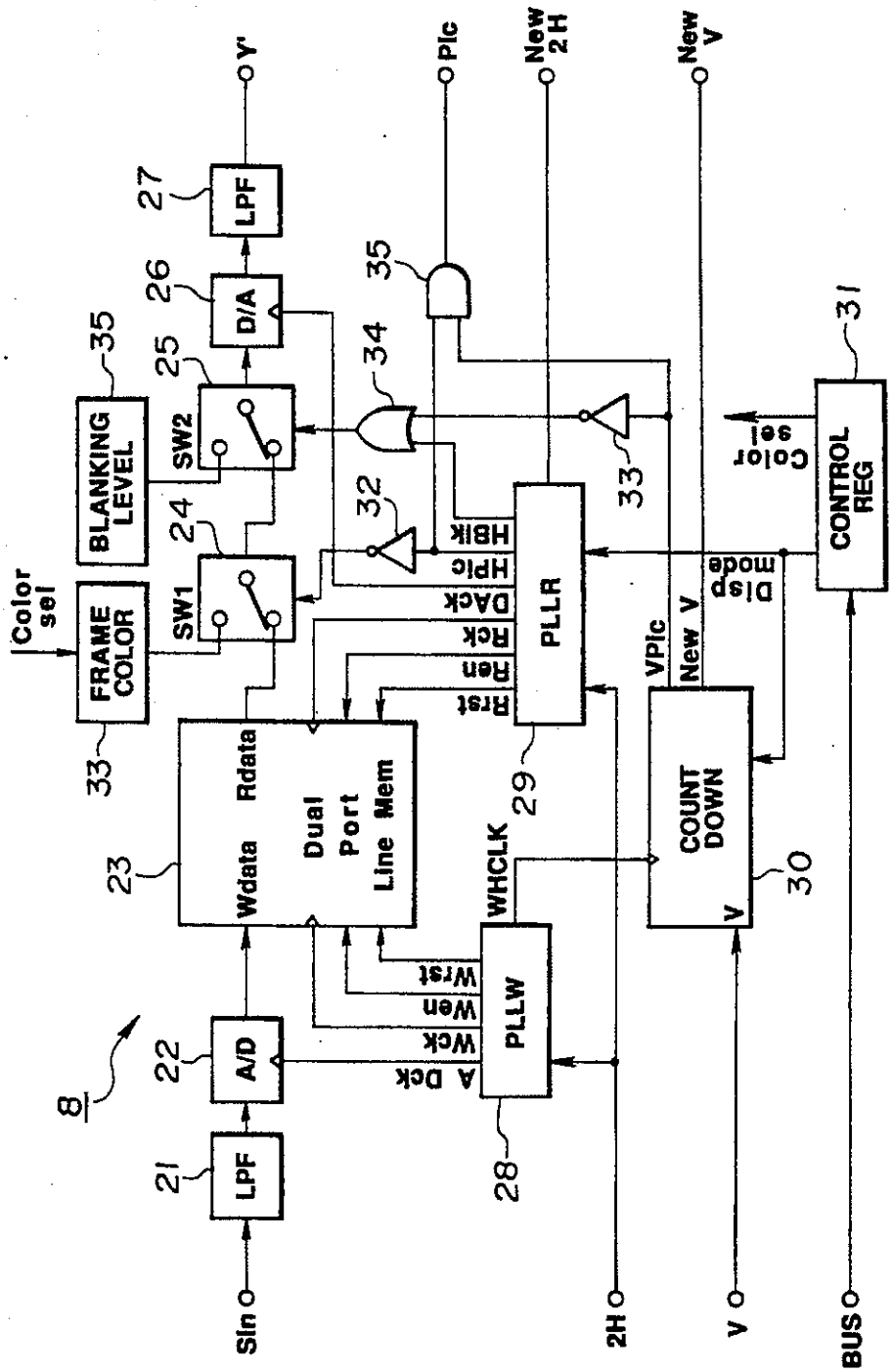

FIG. 6

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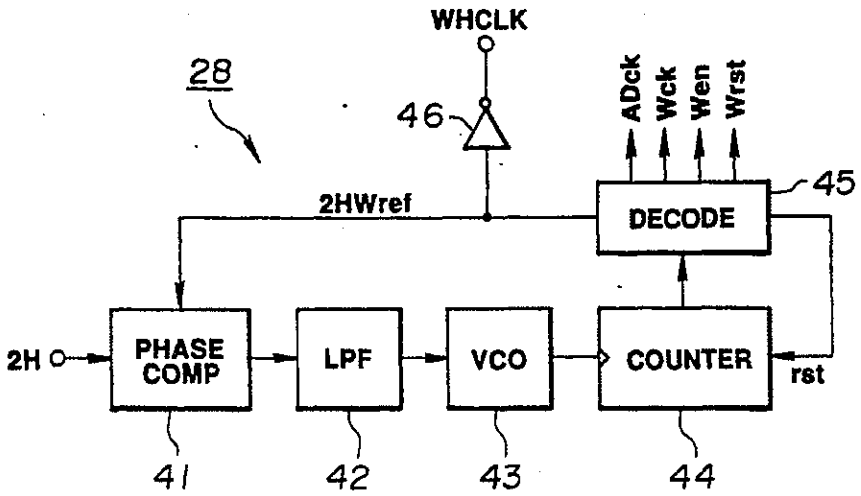

FIG.7

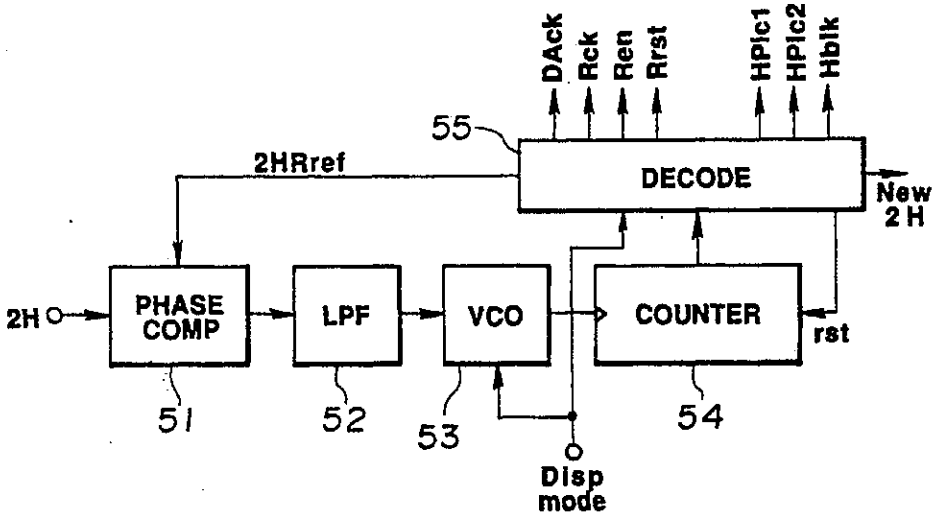

FIG.9

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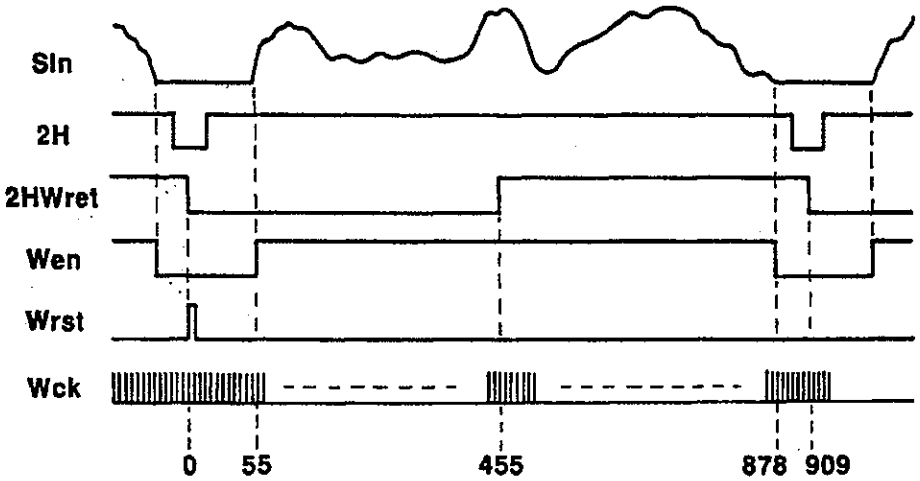

FIG.8

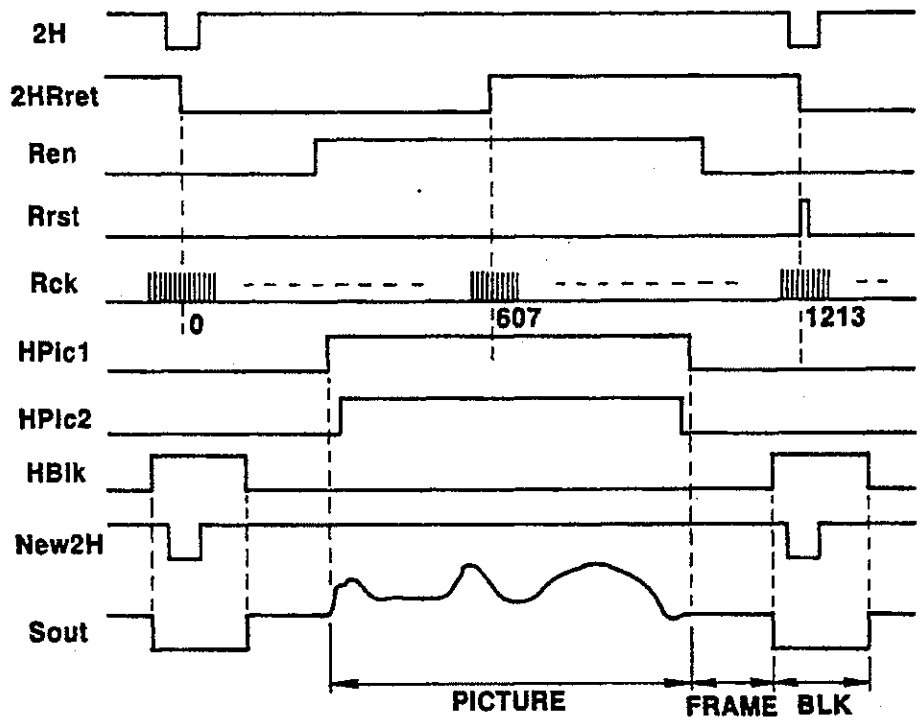

FIG.10

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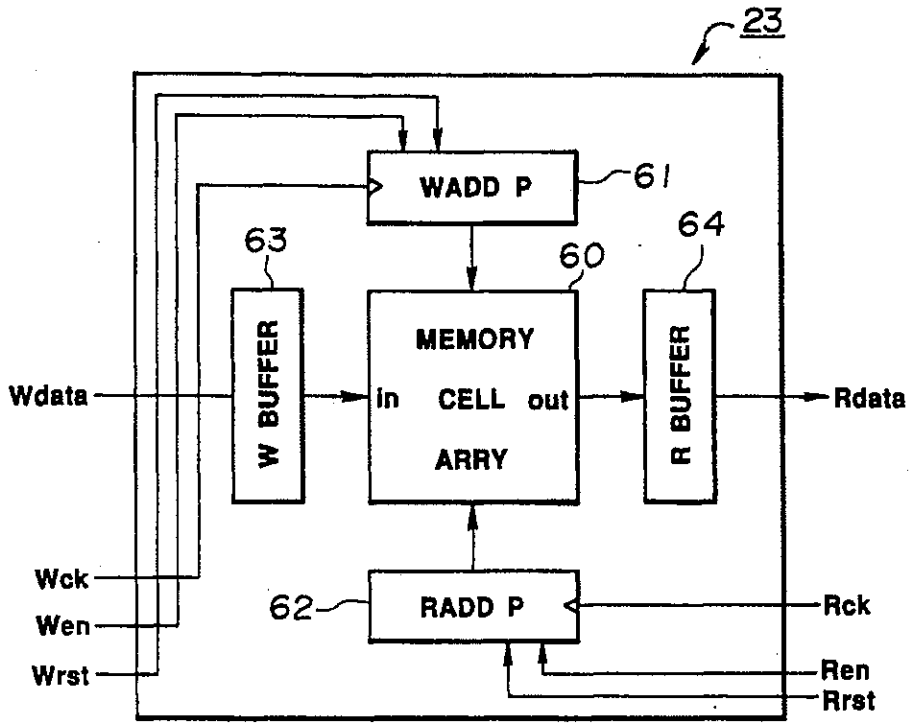

FIG.11

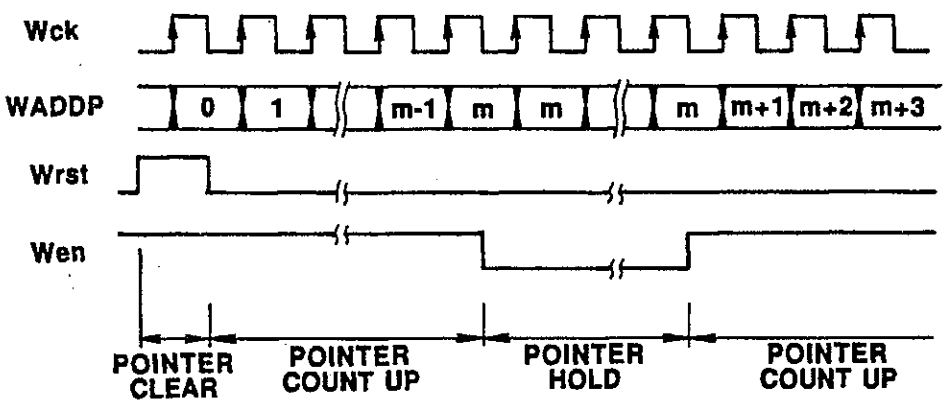

FIG.12

EXHIBIT M
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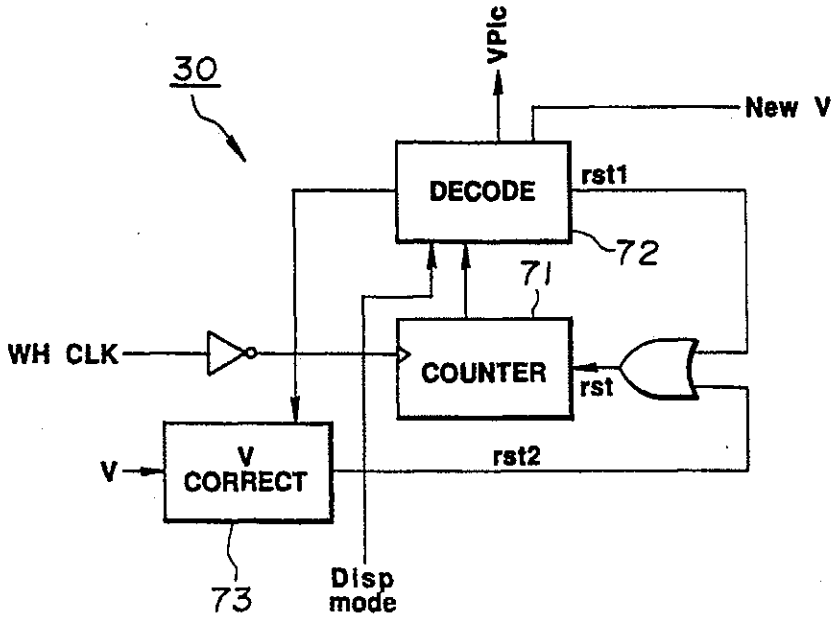

FIG.13

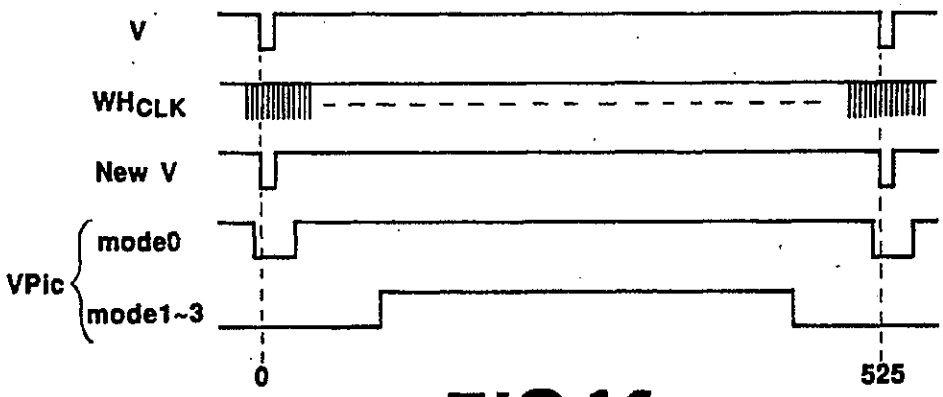

FIG.14

EXHIBIT M
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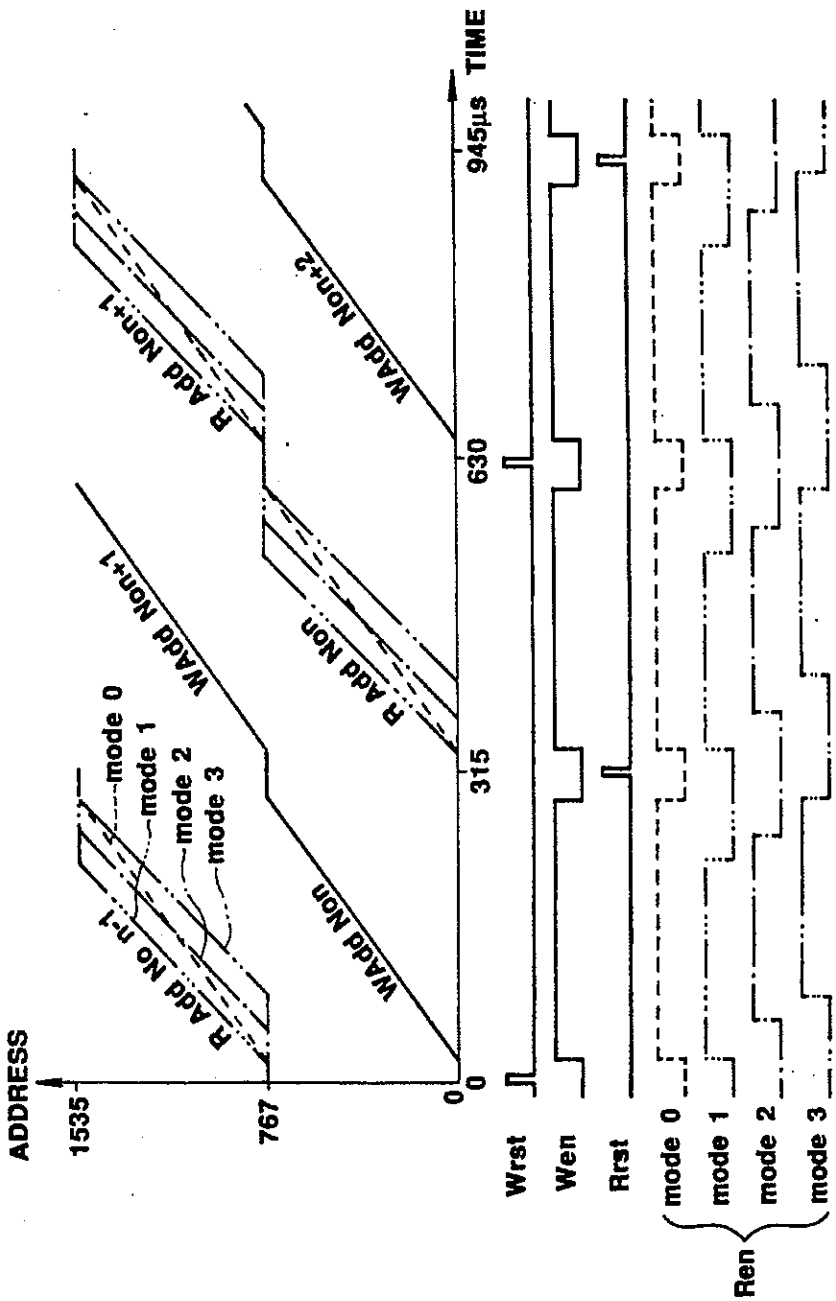

FIG.15

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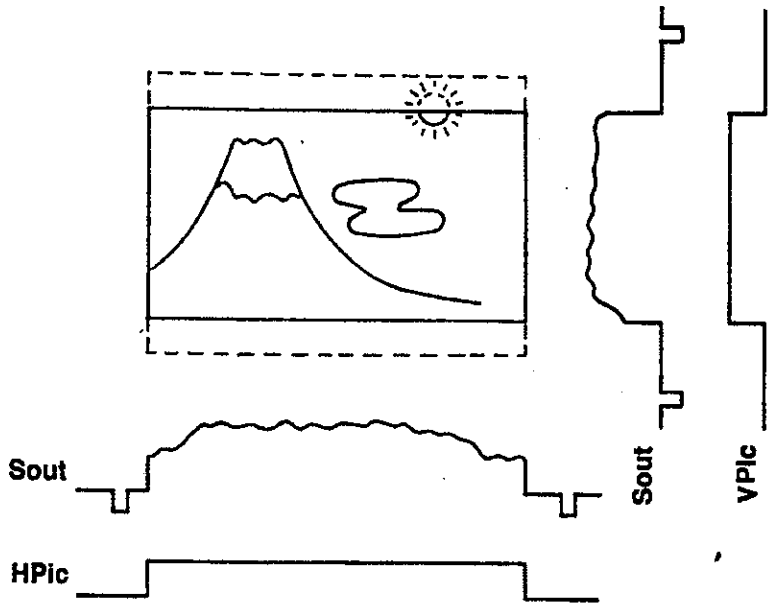

FIG.16

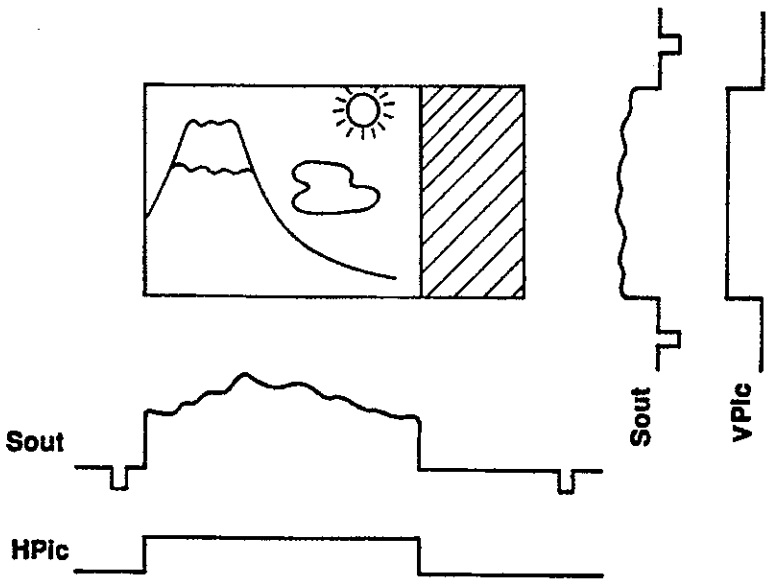

FIG.17

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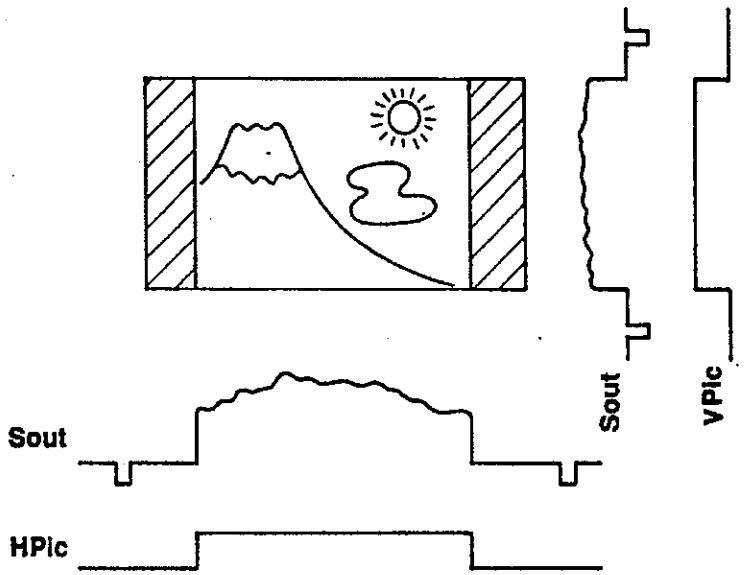

FIG.18

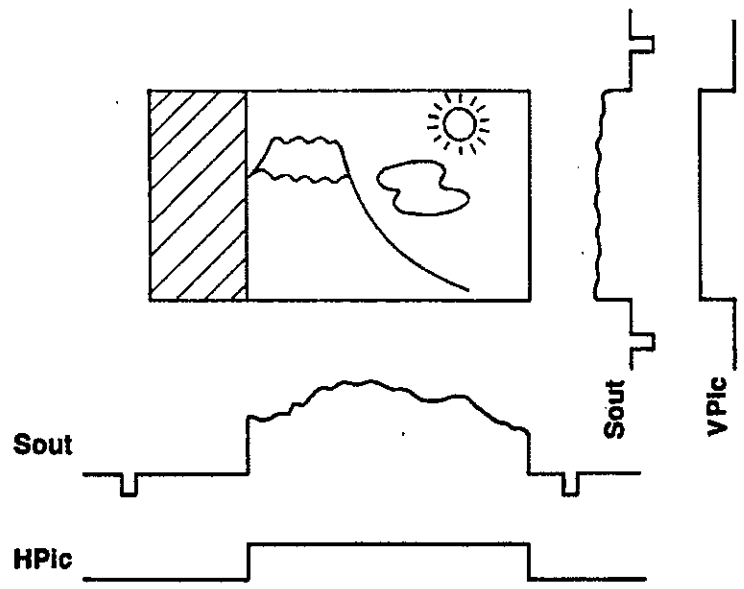

FIG.19

EXHIBIT M
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APPARATUS FOR DISPLAYING STANDARD ASPECT RATIO TELEVISION SIGNAL ON WIDE ASPECT RATIO DISPLAY SCREEN

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an image display apparatus provided with an automatic pedestal processing section for detecting the minimum signal level of input video signals and controlling the signal level of the video signals on the basis of the detected results. The present invention may be applied to, for example, an image display apparatus, such as a television receiver having display means in the form of a display raster or screen having a wide aspect ratio.

2. Description of the Prior Art

An image display apparatus, such as a television receiver, adapted for displaying an image by image signals or video signals by on a display means such as a Braun tube or liquid crystal display, has been known widely. With such image display apparatus, an automatic pedestal processing section for detecting the minimum signal level of the input video signals and controlling the signal level of the video signals on the basis of the detected results is provided in the image signal processing system for displaying an image with excellent picture quality by effective exploitation of the dynamic range of the display means.

Meanwhile, with the present television broadcasting system, the display screen has an aspect ratio of 4:3. In a second generation extended definition TV (EDTV), scheduled to be practiced in future, or a high quality television broadcasting system, such as so-called "high vision" broadcasting system, a widescreen having an aspect ratio of 16:9 is scheduled.

Thus it is estimated that television broadcasting in the future will be made with both the presently adopted standard aspect ratio of 4:3 and the wide aspect ratio of 16:9. For this reason, development of an image display apparatus adapted for displaying images of both types of image signals is proceeding at present.

In such image display apparatus, various display systems such as shown in FIGS. 1 to 4 are presently proposed as the system for displaying the image of the video signals with the standard aspect ratio of 4:3, using display means for the display screen having a wide aspect ratio of 16:9, as an example.

In the first system, upper and lower regions P_1 and P_3 of an image P_N of image signals having a standard aspect ratio are cut as shown in FIG. 1 to display an image P_3 on the entire display screen having a wide aspect ratio. With this first system, the image is displayed on the display screen of the wide aspect ratio by overscanning in the vertical direction of the screen without meddling with the image signals of the standard aspect ratio.

In the second system, as shown in FIG. 2, a right-hand side region A_R of the display raster of the wide aspect ratio is masked and the image P_N of the image signals of the standard aspect ratio is displayed in the left-hand side region of the display raster of the standard aspect ratio. With the second system, the image signals having the standard aspect ratio are compressed along the time axis to three-fourths in the horizontal direction in conformity to the difference in the aspect ratio relative to the display raster of the wide aspect ratio. Frame signals displaying the right-hand side region A_R by, for example, a black tint, are annexed, and the image display is made on the display screen of the wide aspect ratio by usual raster scanning.

In the third system, shown in FIG. 3, left- and right-hand side regions A_{LO} and A_{RO} of the display raster having the wide aspect ratio are masked and the image P_N of the image signals having the standard aspect ratio is displayed at the center of the display screen of the wide aspect ratio. With this third system, image signals of the standard aspect ratio are compressed along the time base to three-fourths in the horizontal direction, in conformity to the difference in aspect ratio relative to the display screen of the wide aspect ratio. Frame signals associated with the left- and right-hand side regions A_{LO} and A_{RO} are affixed and display is made on the display screen of the wide aspect ratio by usual raster scanning.

In the fourth system, shown in FIG. 4, a left-hand side region A_L of the display screen having the wide aspect ratio is masked, and the image P_N of the image signals of the standard aspect ratio is displayed on the right-hand side of the display screen having the wide aspect ratio. With this fourth system, the image signals of the standard aspect ratio are compressed along the time base to three-fourths in the horizontal direction, in conformity to the difference in the aspect ratio relative to the display screen of the wide aspect ratio. Masking signals associated with the left-hand side region A_L are affixed and display is made on the display screen of the wide aspect ratio by the usual raster scanning.

Meanwhile, with the image display apparatus, adapted for displaying the image of the wide aspect ratio and the image of the standard aspect ratio by display means consisting of the display screen having the wide aspect ratio, a problem is raised in that, when an automatic pedestal processing section is provided for improving the picture quality of the displayed image, the masking signal having the signal level within the range of level detection by the automatic pedestal processing section is erroneously detected as being of the black level, so that the automatic pedestal processing section is erroneously actuated and hence it becomes impossible to make image display in such a manner as to take advantage effectively of the dynamic range of the display means.

OBJECT AND SUMMARY OF THE INVENTION

The present invention has been made in view of the above status of the art. A principal object of the present invention is to provide an image display apparatus adapted for displaying an image of the wide aspect ratio and an image of the standard aspect ratio by display means consisting of the display screen of the wide aspect ratio, in which mistaken actuation of the automatic pedestal processing section may be prevented and an image display may be made in such a manner as to take advantage of the dynamic range of the display effectively.

According to the present invention, the automatic pedestal processing section, controlled in operation by a control section, is operated only during the effective display period for input image signals so as to detect the minimum signal level of the input image signals to control the signal level of the image signals on the basis of the detected results. In this manner, with the image display apparatus according to the present invention, mistaken operations of the automatic pedestal processing section due to detection of signals occurring during

the ineffective display period other than the effective display period may be eliminated and the dynamic range of the display means may be effectively exploited to enable image display with the desired excellent picture quality.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic front view showing an image displayed in the first system according to which upper and lower regions of the image by the image signals with the standard aspect ratio are cut and the image display is made on the overall display screen having the wide aspect ratio.

FIG. **2** is a schematic front view showing an image displayed in the second system according to which a right-hand side region of the display screen having a wide aspect ratio is masked and the image of the image signals with the standard aspect ratio is displayed on the left-hand side region of the display screen having the wide aspect ratio.

FIG. **3** is a schematic front view showing an image displayed in the third system according to which left- and right-hand side regions of the display screen having a wide aspect ratio are masked and the image of the image signals with the standard aspect ratio is displayed at the center of the display screen having the wide aspect ratio.

FIG. **4** is a schematic front view showing an image displayed in the fourth system according to which a left-hand side region of the display screen having the wide aspect ratio is masked and the image of the image signals with the standard aspect ratio is displayed on the right-hand side region of the display screen having the wide aspect ratio.

FIG. **5** is a block diagram showing an arrangement of an image display apparatus according to the present invention.

FIG. **6** is a block diagram showing an arrangement of an aspect ratio converting circuit of the image display apparatus shown in FIG. **5**.

FIG. **7** is a block diagram showing an arrangement of a write clock generating circuit of the aspect ratio converting circuit shown in FIG. **6**.

FIG. **8** is a time chart for illustrating the operation of the write clock generating circuit shown in FIG. **7**.

FIG. **9** is a block diagram showing an arrangement of a readout clock generating circuit of the aspect ratio converting circuit shown in FIG. **6**.

FIG. **10** is a time chart for illustrating the operation of the readout clock generating circuit shown in FIG. **9**.

FIG. **11** is a block diagram showing an arrangement of a line memory of the aspect ratio converting circuit shown in FIG. **6**.

FIG. **12** is a time chart for illustrating the operation of data reading from the line memory shown in FIG. **11**.

FIG. **13** is a block diagram showing an arrangement of a countdown circuit of the aspect ratio converting circuit shown in FIG. **6**.

FIG. **14** is a time chart for illustrating the operation of the countdown circuit shown in FIG. **13**.

FIG. **15** is a time chart for illustrating the operation of the aspect ratio converting circuit of FIG. **6** in each of the display modes.

FIG. **16** is a schematic waveform diagram for explaining the position of generation of a control signal used for actuating an automatic pedestal processing circuit during the period of effective display of the image signals in the display mode for displaying the image on the overall display screen having the wide aspect ratio by cutting upper and lower regions of the image of the image signals with the standard aspect ratio.

FIG. **17** is a schematic waveform diagram for explaining the position of generation of a control signal used for actuating an automatic pedestal processing circuit during the period of effective display of the image signals in the display mode for displaying the image of the image signals of the standard aspect ratio on a left-hand region of the display screen of the wide aspect ratio by making the right-hand side region of the display screen with the wide aspect ratio.

FIG. **18** is a schematic waveform diagram for explaining the position of occurrence of a control signal used for actuating an automatic pedestal processing circuit during the period of effective display of the image signals in the display mode for displaying the image of the image signals with the standard aspect ratio in the center of the display screen having the wide aspect ratio by masking the left- and right-hand side reigons of the display screen having the wide aspect ratio.

FIG. **19** is a schematic waveform diagram for explaining the position of occurrence of a control signal used for actuating an automatic pedestal processing circuit during the period of effective display of the image signals in the display mode for displaying the image of the image signals with the standard aspect ratio in the right-hand side region of the display screen having the standard aspect ratio by masking the left-hand side region of the display screen having the wide aspect ratio.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

By referring to the drawings, an illustrative preferred embodiment of the image display apparatus according to the present invention will be explained in detail.

In an image display apparatus **1**, shown in FIG. **5**, the present invention is applied to a high definition television receiver displaying an image by a picture tube **2** having a display raster of a wider aspect ratio of 16:9.

The image display apparatus **1** has a broadcast satellite (BS) tuner circuit **3** for transmitting and receiving signals of satellite broadcasting and a UHF/VHF (U/V) tuner circuit **4** for transmitting and receiving ground waves.

The MUSE signals, obtained as the reception output by the BS tuner circuit **3** of the high definition broadcasting, are supplied to a MUSE decoding circuit **5** and thereby decoded into high quality video signal.

The video signals of the NTSC system, obtained as the reception output by the BS tuner circuit **3** or the U/V tuner circuit **4**, are supplied to a frame rate doubling conversion circuit **7** by means of an input changeover switch circuit **6**. The frame rate doubling conversion circuit **7** processes the NTSC system video signals from the BS tuner circuit **3** or the U/V tuner circuit **4** by frame rate doubling conversion whereby the interlaced scanning mode video signals are converted into sequential scanning mode video signals or double-rate video signals. The double-rate video signals, obtained by the frame rate doubling conversion circuit **7**, are supplied to an aspect ratio converting circuit **8**. This aspect ratio converting circuit **8** processes the double-rate video signals from the frame rate doubling conversion circuit **7** by aspect ratio conversion whereby the

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image having a standard aspect ratio of 4:3 according to the NTSC system is to be displayed on the display screen of the picture tube **2** in accordance with any of the above mentioned first to fourth display systems. The circuit **8** also generates a control signal for indicating the effective display period of the image signals in each of the above display systems by, for example, a logical "H" level.

The high quality video signals, obtained upon decoding the MUSE signals by the MUSE decoding circuit **5**, and the double-rate video signals, processed by the aspect ratio converting circuit **8** by aspect ratio conversion, are selectively supplied to an automatic pedestal processing circuit **10** by means of a signal changeover switch circuit **9**. The automatic pedestal processing circuit **10** remains in operation during the time period when the control signal of the logical "H" level is supplied to its control input terminal **10A** to detect the minimum signal level of the input video signals and processes the input video signals by automatically controlling the signal level of the video signals in their entirety on the basis of the detected signal level. The video signals, the signal level of which has been controlled automatically by the automatic pedestal processing circuit **10**, are supplied to the picture tube **2** by means of an image output circuit **11** for displaying the image on a display screen of the picture tube **2** having the wider aspect ratio of 16:9.

The image display apparatus **1** includes a system controller **13** for accepting the control input by a remote controller **12** to execute various control operations, such as switching control of the switching circuits **6** and **9**, operational control of the aspect ratio converting circuit **8** and deflection angle switching control of the picture tube **2**.

The aspect ratio converting circuit **8** of the image display apparatus **1** of the present embodiment is constructed as shown for example in FIG. **6**.

Thus, as shown in FIG. **6**, the aspect ratio converting circuit **8** includes an analog/digital converter **22** for digitizing the input video signals, that are bandwidth-limited by a low-pass filter **21**, a dual-port line memory **23** for processing the video data digitized by A/D converter **22** by time-base compression, a frame data annexing circuit **24** for annexing frame data to the video data read out from line memory **23**, a blanking data annexing circuit **25** for annexing blanking data to the video data to which the frame data have been annexed by the frame data annexing circuit **24**, a digital-analog converter **26** for converting the video data, to which the blanking data have been annexed by the blanking data annexing circuit **25**, into corresponding analog data and outputting the resulting analog data by means of a low-pass filter **27**, a write clock generating circuit **28** for generating the video data writing timing to line memory **23**, a readout clock generating circuit **29** for generating the video data readout timing from line memory **23**, and a count-down circuit **30** for generating the timing necessary for vertical image processing.

The write clock generating circuit **28** is a PLL circuit for forming 8 f_{SC} reference signals necessary for A/D conversion or writing in the memory, and is constituted by a phase comparator **41**, to which the double-rate horizontal sync signals 2H, formed in the frame rate doubling conversion circuit **7**, are supplied as the reference signals, a voltage controlled oscillator **43**, to which an output of phase comparison by the phase comparator **41** is supplied as the control signal by means of a low-pass filter **42**, a counter circuit **44** counting the oscillation output of the voltage controlled oscillator **43**, and a decoding circuit **45** decoding the count output from the counter circuit **44**, as shown for example in FIG. **7**.

In the write clock generating circuit **28**, a signal having a frequency of approximately 28 MHz, or 910 times the frequency of the horizontal sync signals 2H, is generated by the voltage-controlled oscillator **43** and frequency-divided by 1/910 by the counter circuit **44** and the decoder circuit **45** to form a comparison signal $2HW_{ref}$, which comparison signal $2HW_{ref}$ is phase-compared in the phase comparator **41** with the horizontal sync signal 2H, in a closed loop configuration. The count output from the counter circuit **44** is decoded by the decoding circuit **45** to produce clock signals AD_{ck} for providing an operational timing of the A/D converter **22**, write clocks W_{ck} for providing the video data write timing to the line memory **23**, write control signals W_{en} for delimiting the write domain in the line memory **23**, and reset control signals W_{rst} for initializing the write address pointer in the line memory **23**. The waveforms of these signals are shown in FIG. **8**.

The readout clock generating circuit **29** is a PLL circuit for forming reference signals necessary to perform the readout operation from the memory, and is adapted for generating the two types of reference signals as a function of the operating modes. As shown for example in FIG. **9**, the readout clock generating circuit **29** is constituted by a phase comparator **51**, to which the double-rate horizontal synchronizing signals 2H, formed in the above mentioned frame rate doubling conversion circuit **7**, are supplied as the reference signals, a voltage controlled oscillator **53**, to which the phase comparison output from the phase comparator **51** is supplied as the control signal by means of a low-pass filter **52**, a counting circuit **54** for counting the oscillation output of the voltage controlled oscillator **53** and a decoding circuit **55** for decoding the count output of the counting circuit **54**.

In the readout clock generating circuit **29**, the operation of each of the voltage controlled oscillators **53** and the decoding circuit **55** is switched by control data in conformity to the display mode supplied from the system controller **13** to the control register **31**. Thus, on reception of control data of the display mode according to the above mentioned first display system (mode **0** control data), the readout clock generating circuit **29** constitutes a PLL circuit generating reference signals having the frequency of 8 fsc, similar to the above mentioned write clock generating circuit **28** and, on reception of control data of the display mode according to the above mentioned second to fourth display systems (mode **1** to **3** control data), the readout clock generating circuit **29** constitutes a PLL circuit generating reference signals having the frequency of 8 f_{SC}, similar to the write clock generating circuit **28**. Likewise, on reception of control data according to the above mentioned first to fourth display systems (mode **1** to **3** control data), the circuit **29** constitutes a PLL circuit generating reference signals having the 4/3-fold frequency, that is the frequency equal to 1213 times the above mentioned reference frequency 2H, or about 38 MHz.

Referring to FIG. **10**, the decoder circuit **55** decodes the count output from the counter circuit **54** to generate clock signals DA_{ck} for providing the operational timing for the D/A converter **26**, readout clocks R_{ck} for providing the readout timing for reading out image data from line memory **23**, write control signals R_{en} for de-

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limiting the readout domain of the line memory **23**, reset control signals R_{rst} for initializing a readout address pointer in the line memory **23**, control signals HP_{lc} necessary for frame data addition and automatic pedestal processing, control signals HB_{lk} necessary for blanking data addition, and new horizontal synchronizing signals NEW 2 H.

The timing of generation of each of the control signals R_{en}, R_{rst} and HP_{lc}, generated by the readout clock generating circuit **29**, is switched by control data supplied to the control register **31**. Thus the signals R_{en}, R_{rst} and HP_{lc} are generated at the timings conforming to the display position in the image display screen in accordance with the display modes (modes **0** to **3**).

FIG. **10** shows the case of the display mode according to the above mentioned third system (mode **2**).

It is noted that stabilized timing generation may be realized with the readout clock generating circuit **29** even when no signals are received during broadcast reception and no reference signals 2 H are received, because the voltage controlled oscillator **53** may continue its operation in the free-running state.

Meanwhile, the line memory **23** of FIG. **6** is a FIFO type line memory for asynchronous data writing and reading and includes, as shown in FIG. **11**, a memory cell array **60**, a write address pointer **61** for applying a write address to the memory cell array and a readout address pointer **62** for applying a readout address to the memory cell array **60**. Input data W_{data} entered by means of an input buffer **63** are written in a memory cell of the memory cell array **60** which is designated by the write address applied from the write address pointer **61**, while output data R_{data} read out from a memory cell of the memory cell array **60** designated by the readout address applied from the readout address pointer **62** are outputted at an output buffer **64**.

In the line memory **23**, the write clock signals W_{ck} and the various control signals W_{en} and W_{rst}, generated by the write clock generating circuit **28**, are supplied to the write address pointer **61**, while the readout clock signals R_{ck} and the control signals R_{en} and R_{rst}, generated by the readout clock generating circuit **29**, are supplied to the readout address pointer **62**. To the input buffer **63**, image data digitized by the A/D converter **22** are supplied as the above mentioned input data W_{data}.

The input data W_{data}, entered to the memory cell array **60** by means of the input buffer **63**, are written by the write address pointer **61**, during the period when the write control signal W_{en} is at the logical high level, in a memory cell of the memory cell array **60** which is accessed in synchronism with the rising of the write clock signal W_{ck}.

Referring to FIG. **12**, the write address pointer **61** is counted up by the write clock signal W_{ck}, during the interval when the write control signal W_{en} is at the logical high level, to access the next address memory cell of the memory cell array **60**. On the other hand, when the write control signal W_{en} is at the logical low level, count-up of the write address pointer **61** is inhibited. This causes data writing into the memory cell array **60** to be discontinued. The write control signal W_{en} delimits the data write domain. On the other hand, during the time interval when the reset control signal W_{rst} is at the logical high level, the write address pointer **61** is initialized in synchronism with the rising of the write clock signal W_{ck} to access the O-address memory cell.

It is noted that the write address pointer **61**, supplied with the readout clock signals R_{ck} and the control signals R_{en} and R_{rst}, generated by the readout clock generating circuit **29**, performs an operation similar to that of the write address pointer **61**.

The line memory **23** is capable of performing asynchronous data writing and reading, such that, by setting the frequency of the readout clock signals R_{ck} so as to be equal to 4/3 times that of the write clock signals W_{ck}, the line memory causes the image to be compressed by a factor of $\frac{3}{4}$ in the horizontal direction to realize the image display according to the display modes **1** to **3** of the aforementioned second to fourth display systems. Meanwhile, in the display mode of the first display system (mode **0**), the frequency of the write clock signals W_{ck} is set so as to be equal to that of the readout clock signal R_{ck}.

The count-down circuit of FIG. **6** is constituted, as shown for example in FIG. **13**, by a counter circuit **71**, to which the comparison signal 2 HW_{ref} generated by the write clock generating circuit **28** is supplied as clock signal WH_{clk} by means of an output buffer **46**, and a decoder circuit **72** for decoding the count output from the counter circuit **71**.

It is noted that the comparison signal 2 HW_{ref}, generated by the write clock generating circuit **28**, that is the aforementioned clock signal WH_{clk}, has its rising edge situated at approximately the same position as the double rate horizontal synchronizing signal 2 H generated by the aforementioned frame rate doubling conversion circuit **7** and is synchronized with the horizontal synchronizing signal 2 H, although with a stationary phase error. That is, the clock signal WH_{clk} may be regarded as being similar to the horizontal sync signal 2 H.

The counter circuit **71** in FIG. **13** is reset by a reset control signal rst **2** from a waveform correction circuit **73** to count 525 clock signals WH_{clk}, which number is equal to the number of the double-rate raster scanning lines. The reset control signal rst **2** is generated in the waveform correction circuit **73** by eliminating the jitter component from the vertical sync signal V.

The decoder circuit **72** decodes the count output from counter circuit **71** to output a new vertical synchronizing signal NEWV, and a control signal VP_{lc}, as shown in FIG. **14**. The control signal VP_{lc} is used for annexing the flanking data and indicates the image domain in the vertical direction by the logically high level.

Meanwhile, the counter circuit **71** is reset by the logical sum of a reset control signal rst **1**, generated by the decoder circuit **72**, and a reset control signal rst **2**, generated from the vertical sync signal V by the waveform correction circuit **73**. In this manner, even when the vertical sync signal V has been unable to be detected at the normal position due to, for example, the weak electrical field during broadcast reception, the stable reset control signal rst **1** guarantees correct resetting of the counter circuit **71**. In order to provide for stable resetting of the counter circuit **71**, the waveform correcting circuit **73** judges the relation between the clock signal WH_{clk}, that is the double-rate horizontal sync signal 2 H, and the vertical synchronizing signal V. If the relation is found to be within a predetermined allowable range in view of the EDTV standards, the reset control signal rst **2** is outputted and, if otherwise, the signal rst **2** is not outputted.

In the count-down circuit **30**, of FIG. **6**, the signal used as the clock signal for the counter circuit **71** is not the double-rate horizontal synchronizing signal 2 H,

generated by the above-mentioned frame rate doubling conversion circuit **7**, but rather the clock signal WH_{clk} generated by the write clock generating circuit **28** from the comparison signal 2 HW_{ref}, so that, even when the double-rate horizontal sync signal 2 H is interrupted under the nil-signal state caused by, for example, a weak electrical field during broadcast reception, the clock signal WH_{cek} continues to be output due to the free-running of the voltage-controlled oscillator **43** of the write clock generating circuit **28**. Thus the counter circuit **71** of FIG. **13** may continue its counting operation to output the vertical synchronizing signals NEWV and the control signals VP_{ic} as stable signals.

FIG. **15** shows the relation between the control signal W_{en} and W_{rst}, generated by the write clock generating circuit **28**, and the control signals R_{en} and R_{rst}, generated by the readout clock generator **29** for the display modes (modes **0** to **3**), and the relation between the addresses of the write address pointer **61** and the readout address pointer **62** within the line memory **23**.

In the above described aspect ratio converting circuit **8** of FIG. **6**, the dot-sequential mode video signals generated by the frame rate doubling conversion circuit **7**, that is, the double-data video signals, are bandwidth limited by the low-pass filter **21** and processed by anti-aliasing processing before being supplied to the A/D converter **22** where the signals are digitized. The digitized video data from the A/D converter **22** are supplied to and written in the line memory **23** in accordance with the write clock signals W_{ck} generated by the write clock generating circuit **28** and the control signals W_{en} and W_{rst}.

Meanwhile, the write control signal W_{en}, generated by the write clock generating circuit **28**, falls to a logical low level during the blanking domain of the input video signal, so that data writing in the line memory **23** is interrupted during this domain and data writing is performed only during the image domain necessary for processing so as to save the storage capacity of the line memory **23**. The data of the blanking domain not written at this time are added at the readout side circuit.

The reset control signal R_{rst}, generated by the readout clock generating circuit **29**, adapted for performing readout control of the line memory **23**, is generated at a position delayed by one horizontal scanning period with respect to the reset control signal W_{rst} generated by the write clock generating circuit **28**, thereby preventing collision between the readout address and the write address.

Since compression in the horizontal direction is not performed with the display mode of the first system (mode **0**), the readout control signal R_{en}, generated by the readout clock generating circuit **29**, is coincident in timing with the write control signal W_{en}. With the present display mode (mode **0**), since the write clock signal, the write clock signal W_{ck} and the readout clock signal R_{ck} are of the same frequency, the video data read out from line memory **23**, delayed by 1 H from the data at the write side, are substantially the same as the latter data.

With the display mode according to the second to fourth systems (modes **1** to **3**), video data are read out from the line memory **23** during the domain when the readout control signals R_{en} associated with the respective display modes are at the logical high level, so that the image is displayed at the corresponding position. In these display modes, the frequency of the readout clock signal R_{ck} is four-thirds that of the write clock signal W_{ck}, so that the image data in the line memory **23** is read out at a rate equal to four-thirds of that at the write side, as a result of which a display image compressed to three-fourths in the horizontal direction is obtained.

The control signal HP_{ic}, generated by the readout clock generating circuit **29**, is at the logical high level within the region of the image to be displayed in the horizontal direction, that is, within the effective display period, in each of the display modes **0** to **3**.

FIG. **16** shows the display state for the display mode **0** wherein upper and lower regions of the image of the standard aspect ratio are cut to display the image on the overall display screen having a wide aspect ratio. FIG. **17** shows the display state in the display mode **1** in which the right-hand side region of the display raster of the wide aspect ratio is masked to display the image of the image signals of the standard aspect ratio on the left-hand side of the display screen of the wide aspect ratio. FIG. **18** shows the display state in the display mode **2** in which left-hand and right-hand side regions of the display raster having the wide aspect ratio are masked and the image of the image signals having the standard aspect ratio is displayed in the middle of the display raster of the wide aspect ratio. Finally, FIG. **19** shows the display state in the display mode **3** in which the left-hand side region of the display raster of the wide aspect ratio is masked and the image of the image signals of the standard aspect ratio is displayed in the right-hand side region of the display raster of the wide aspect ratio.

The control signal HP_{ic} from readout clock generating circuit **29** in FIG. **6** is inverted in polarity by inverter **32** so as to be supplied as a changeover control signal to the frame data addition circuit **24**. The frame data addition circuit **24** is constituted by a switch circuit which is adapted for selecting the line memory **23** when the switching control signal is at the logical low level, and which is adapted for selecting a frame data output section **33** when the changeover control signal is at the logical high level to affix frame data to those portions of the image data read out from the line memory **23** which are outside the effective image display region.

The control signal VP_{ic}, generated by the countdown circuit **30**, is at the logical high level within the region of the image to be displayed in the vertical direction, that is, during the effective display period. This display signal VP_{ic} has different signal-generating timings between the display mode of the first display system (mode **0**) and the display mode of the other display systems (modes **1** to **3**).

The above mentioned control signal VP_{ic}, indicating the effective display period in the vertical direction by the logical high level is inverted in polarity by inverter **36**, and supplied to an OR gate **34** that performs the logic OR operation between the inverted signal VP_{ic} and the control signal HB_{lk} from the readout clock generating circuit **29**. The logical sum output from this OR gate **34** is supplied to the blanking data affixing circuit **25** as a changeover control signal.

This blanking data affixing circuit **25** is constituted by a switch circuit, which is adapted to select the frame data affixing circuit **24** or the blanking data output section **37** when the changeover control signal is at the logical low level or at the logical high level, respectively. Vertical and horizontal blanking data are affixed by the blanking data affixing circuit **25** to the video data, to which the frame data have been affixed by the frame data affixing circuit **24** as described previously.

The output data from the blanking data affixing circuit **26** are converted by the D/A converted **26** into analog signals and processed by a low-pass filter **27** for anti-aliasing so as to be outputted as the image signals of the display modes **0** to **3**.

On the other hand, the control signal HP_{ic}, indicating the horizontal effective display period, formed by the readout clock generating circuit **29**, by the logical high level, and the control signal VP_{ic}, indicating the vertical effective display domain, formed by the countdown circuit **30**, by the logical high level, are transmitted to an AND circuit **35**, where the AND operation is taken of these two signals. The AND output of the AND gate **35**, indicating the effective display domain of the image signal of the display modes **0** to **3** by the logical high level, is supplied to the control input terminal **10A** of the automatic pedestal processing circuit **10** as the operation control signal P_{ic}.

In this manner, the automatic pedestal processing circuit **10** is in operation only during the effective display period in the display modes **0** to **3**, so that optimum automatic pedestal processing may continously be made without malfunctions otherwise caused by detection of the signals during the ineffective display period, that is, during the period other than the effective display period.

I claim:

1. A display apparatus for displaying image signals contained in input television signals formed of scanning lines with a blank periods and display periods comprising:

receiving means for receiving at least two types of television signals, the aspect ratio of a first type of the television signals being wider than the aspect ratio of a second type of the television signals and having different respective display periods;

display means for displaying said television signals, said display means having an aspect ratio of said first type of the television signals;

aspect ratio converting means for converting said second type of television signals for display on said display means;

detecting means for detecting a predetermined minimum level of image signals in the input television signals;

automatic pedestal processing means for controlling the signal level of said image signals using output signals of said detecting means; and

control means for determining a display period of the input image signals and controlling said automatic pedestal processing means only within the determined display period of said image signals, wherein said control means generates a window signal so as to pass said image signals to said automatic pedestal processing means only during said determined display period of said image signals.

2. A display apparatus according to claim **1** wherein said control means generates a selecting signal fed to said aspect ratio converting means for selecting one of a number of modes for displaying said second type of television signals on said display means, in a first of said number of modes said second television signal is overscanned in the vertical direction of said display means and in a second of said number of modes the display period of said second television signal is displayed on said display means with frame data.

3. A display apparatus according to claim **2** wherein said aspect ratio converting means includes adder means for adding said frame data to said second type of television signals so as to have the same aspect ratio on said display means in said second mode.

4. A display apparatus according to claim **2** wherein said first mode creates display signals scanned on a visible display area on said display means and a non-display signal scanned on a non-visible display area thereon, and in which said non-display signal is scanned in upper and lower areas of said visible display area.

5. A display apparatus according to claim **2**:

wherein said first type television signal is based on MUSE television format and said second type television signal is based on NTSC television format.

6. A display apparatus according to claim **2**:

wherein said aspect ratio of said second type television signal is 4:3 and said aspect ratio of said first type television signal is 16:9.

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US005539425A

United States Patent [19]

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[54] **DISPLAY UNIT**

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[58] **Field of Search** 348/173, 805, 348/556, 28, 673, 687, 691, 677, 695, 675; 345/63, 147, 77

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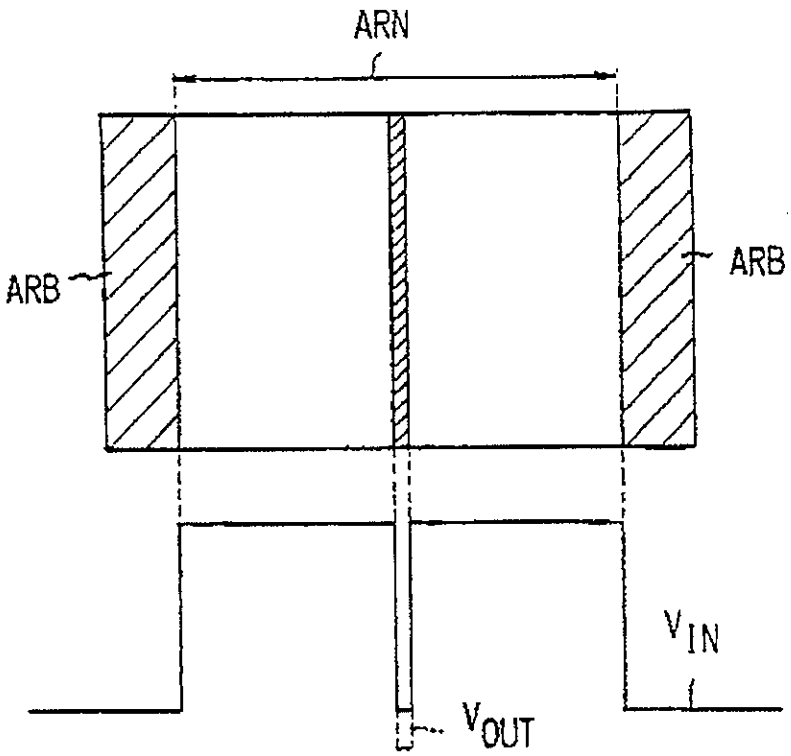
Primary Examiner—Ulysses Weldon
Assistant Examiner—Amare Mengistu
Attorney, Agent, or Firm—Hill, Steadman & Simpson

[57] **ABSTRACT**

A display unit in which a black level is set to a predetermined level in a first display screen having a first aspect ratio and a black level is set to a predetermined level in a second display screen having a second aspect ratio is provided. A darkest signal of a video signal is detected from an image area corresponding to the second display screen. The darkest signal is lowered to a predetermined level in an image area corresponding to the first display screen. In accordance with the principles of the present invention, the situation where a video signal of the second display screen that is to be lowered will not be lowered can be prevented.

8 Claims, 4 Drawing Sheets



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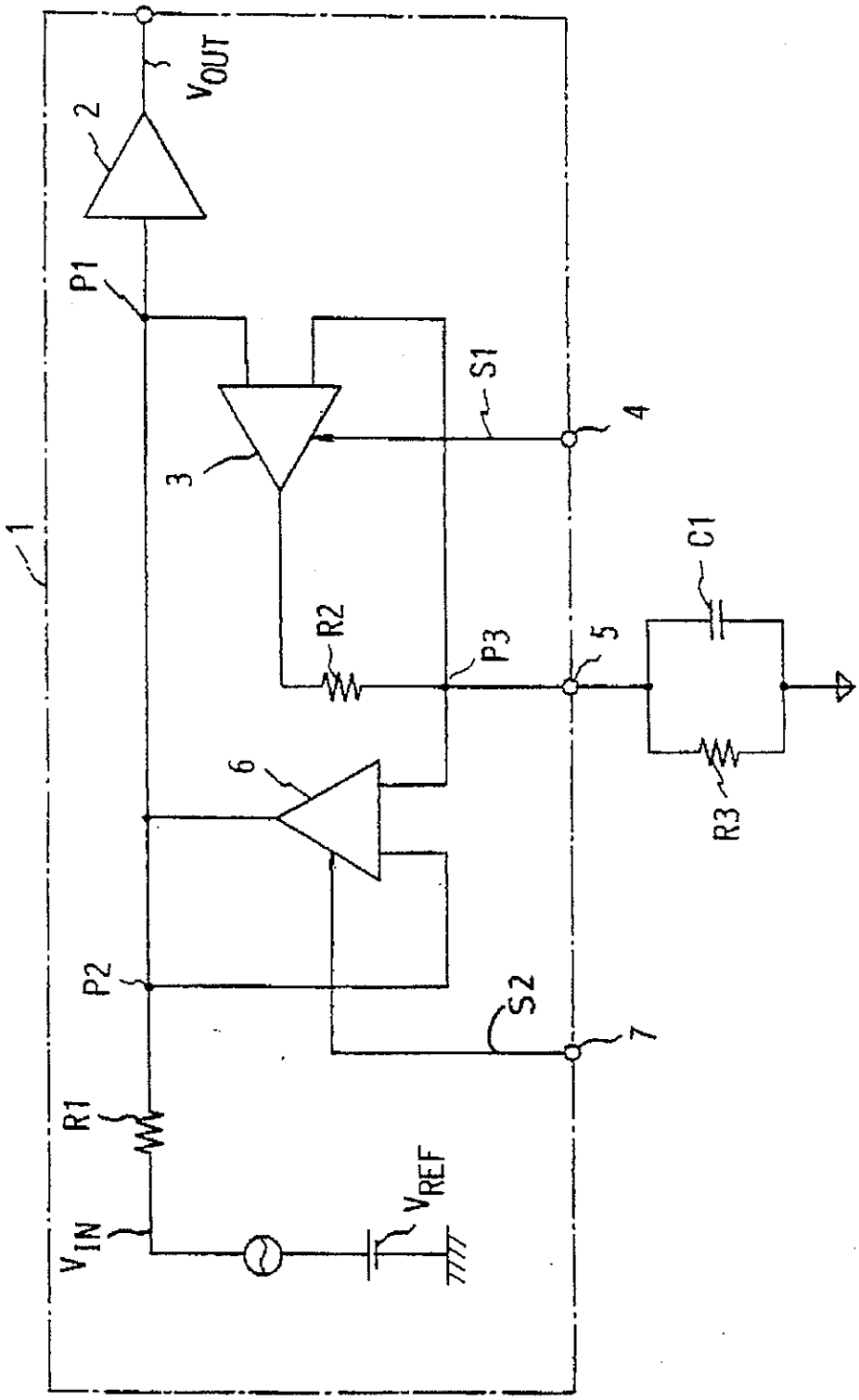

FIG. 1

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FIG. 2A

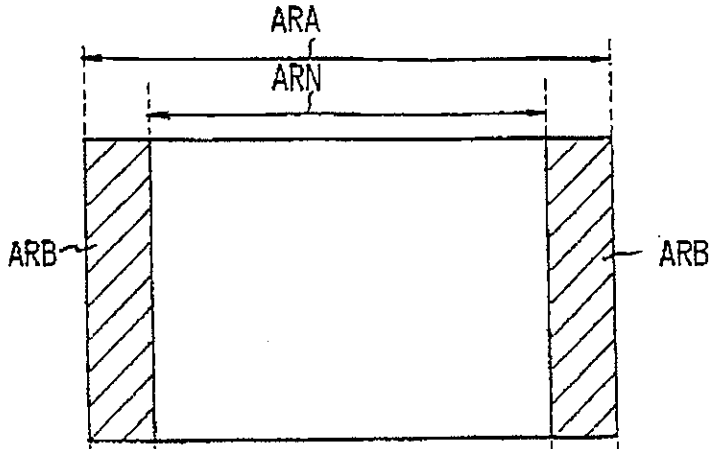

FIG. 2B

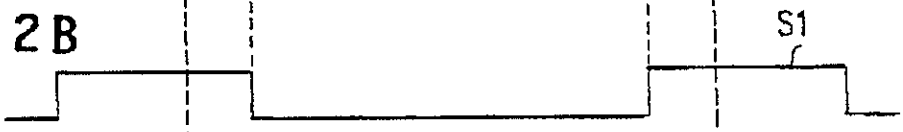

FIG. 2C

FIG. 3A

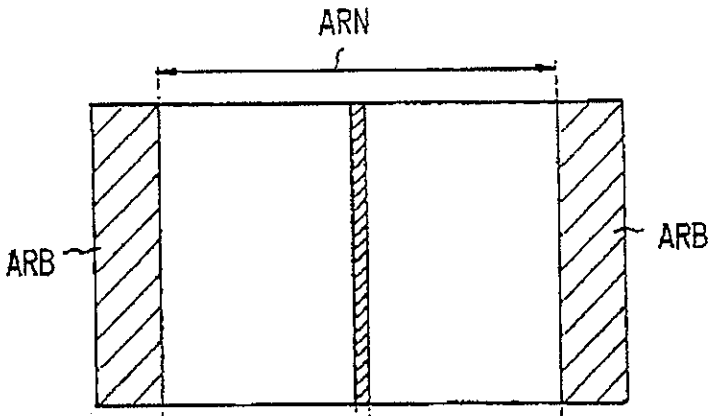

FIG. 3B

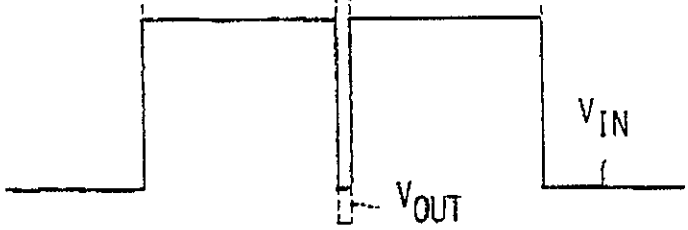

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FIG. 4A

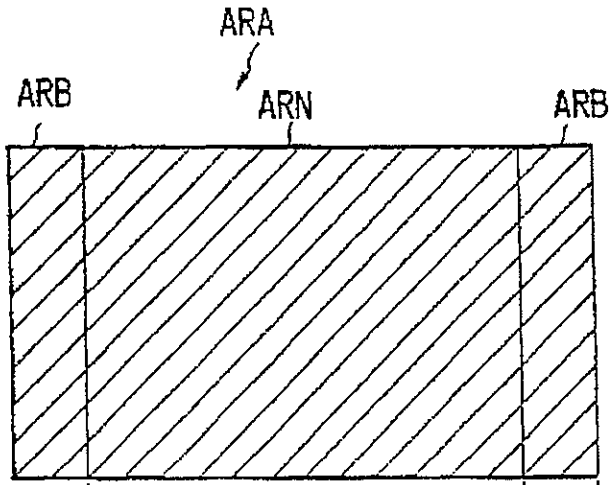

FIG. 4B

FIG. 4C

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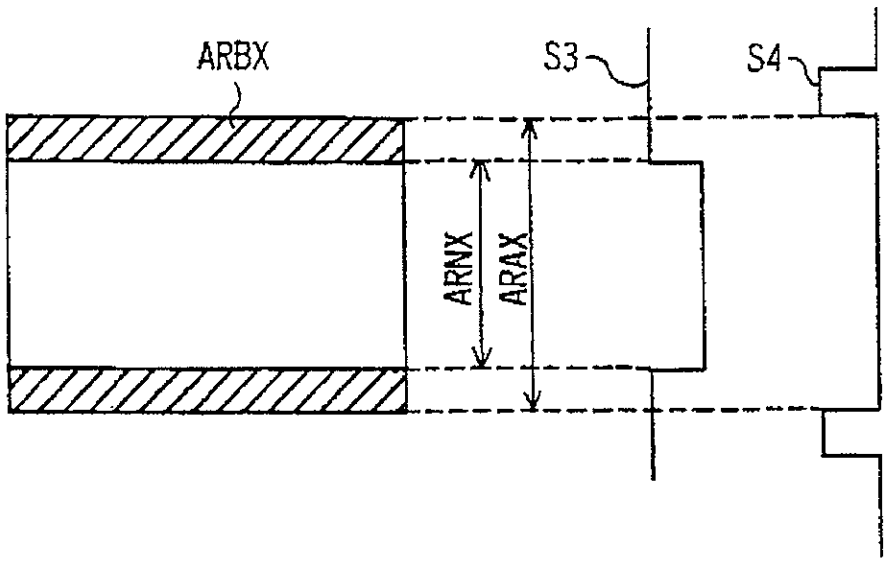

FIG. 5A FIG. 5B FIG. 5C

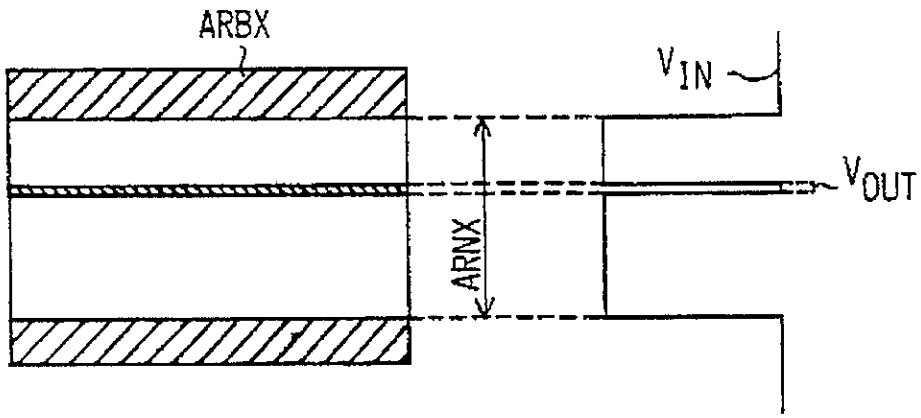

FIG. 6A FIG. 6B

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DISPLAY UNIT

This is a continuation of application Ser. No. 07/904,091 filed Jun. 25, 1992, now abandoned.

BACKGROUND OF THE INVENTION

The present invention relates to a display unit, and is preferable particularly for use on a display unit capable of displaying image screens having a different aspect ratio each on the same screen.

In a television receiver for NTSC system comprising a screen aspect ratio at 4 to 3, in case, for example, a slight black signal is included in an image high in a mean brightness level like a boundary of a bright background and hair, a black portion of the hair is seen to be afloat visually, and hence proposed hitherto is a black signal correction system for enhancing the black portion of the picture by lowering a level of the black signal.

The black signal correction system comprises detecting the darkest signal level in a video signal, lowering the black signal level to a pedestal level to a thicker visibility.

Meanwhile, it is conceivable that such black signal correction system applied not only to the conventional television receiver but also to a high vision receiver for correcting video signals which may ensure images improved still further.

SUMMARY OF THE INVENTION

In view of the foregoing, an object of this invention is to provide to a display unit for use in a television receiver, which is capable of displaying two video signals that are different in display area on the same screen, the display unit being capable of ensuring an image with a quality that is further improved by correcting a black level of the video signal.

The nature, principle and utility of the invention will become more apparent from the following detailed description when read in conjunction with the accompanying drawings in which like parts are designated by like reference numerals or characters.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. **1** is a circuit connection diagram representing a display unit of one embodiment of the present invention;

FIGS. **2**A to 2C are a schematic depiction of a wide aspect display and signal waveform diagrams serving for illustration of a black level detection signal and a blanking pulse signal;

FIGS. **3**A and **3**B are a schematic depiction of a wide aspect display and a signal waveform diagram serving for illustration of an operation when a video signal that is high in average brightness level is inputted;

FIGS. **4**A to 4C are a schematic depiction of a wide aspect display and signal waveform diagrams serving for illustration of an operation when a video signal having a uniform signal level is inputted to a whole image display area;

FIGS. **5**A to 5C are a schematic depiction of a conventional aspect display showing a cinema format image and signal waveform diagrams serving for illustration the black level detection signal and the blanking pulse signal in a second embodiment of the present invention; and

FIGS. **6**A and **6**B are a schematic depiction of a conventional aspect display and a signal waveform diagram serving for illustration the picture corresponding to an NTSC system in the second embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

In order to solve the such problem described above, in a display unit as shown schematically in FIG. 2*a* for displaying, in a first display screen ARA having a first aspect ratio at 16 to 9, a second display screen ARN having a second aspect ratio at 4 to 3 with a vertical screen length substantially the same as a length of the first display screen, and a horizontal screen length shorter than the first display screen length, displaying an image of a black level in an extra area ARB of the second display screen ARN, a first aspect of the invention comprises signal level expansion means **6** as shown in FIG. **1** for lowering the darkest signal level in the image overall of the display screen to a predetermined level, when the image is displayed in the first display screen ARA.

Further, in the display unit for displaying, in the first display screen ARA having a first aspect ratio at 16 to 9, the second display screen ARN having a second aspect ratio at 4 to 3 with a vertical screen length substantially the same as a length of the first display screen, and a horizontal screen length shorter than the first display screen length, displaying an image of a black level in the extra area ARB of the second display screen ARN, a second aspect of the invention comprises signal level detection means **3** for detecting the darkest signal level in the image only in the second display screen ARN excepting the black-framed screen ARB, when the image is displayed in the second display screen ARN, and signal level expansion means **6** for lowering the signal level to a predetermined level according to a detected result of the signal level detection means **3**.

According to the first aspect of the invention, when an image is displayed in the first display screen ARA, the signal level expansion means **6** lowers a black signal of the image displayed in the first display screen ARA from a black level to outputting, therefore in case images of a signal level are inputted to the second display screen ARN and the extra area ARB, a probability of a boundary of the areas being sensed visually can effectively be avoided.

According further to the second aspect of the invention, when an image is displayed in the second display screen ARN of the first display screen ARA, a black signal of a video signal V_{IN} is detected by the signal level detection means **3** only in the second display screen ARN, the detected black signal is lowered from the black level by the signal level expansion means **6**, thereby avoiding effectively a probability that the darkest signal level in the second display screen ARN will not be lowered to a predetermined level due to the signal level detection means **6** having detected erroneously the image of the extra area ARB as the darkest.

Preferred embodiments of this invention will be described with reference to the accompanying drawings.

In FIG. **1**, a reference numeral **1** indicates a black level correction circuit as a whole, wherein an input video signal V_{IN} superposed on a predetermined reference voltage V_{REF} is outputted through a resistance R1 and an amplification circuit **2** in operational amplifier construction.

The input video signal V_{IN} is supplied to a black level detection circuit **3** in operational amplifier construction which is connected to a connection node P1 whereat the resistance R1 and the amplification circuit **2** are connected.

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The black level detection circuit 3 detects to hold the darkest signal level of the input video signal V_{IN}, when a black level detection signal S1 inputted from a black detection pulse input terminal 4 is low, and stops detection of the darkest signal level of the input video signal V_{IN}, when the black level detection signal S1 is high.

An arrangement is such that the black level detection signal S1 is low in the display area ARN (hereinafter referred to as NTSC image display area) as shown in FIG. 2A on which an NTSC image signal indicated by an aspect ratio at 4 to 3 against the display area ARA (so-called wide screen) of a high vision video signal indicated by an aspect ratio at 16 to 9, and is high in the black-framed areas ARB on opposite ends of the screen (FIG. 2B).

The black-framed area ARB is an area coming outside of the NTSC image display area ARN, and the video signal V_{IN} in the black-framed area ARB has a signal level substantially of the black level.

In this case the black level hold circuit 3 is capable of holding the signal level darkest in the NTSC image display area ARN, signals substantially of the black level in the left and right black-framed areas ARB are detected, thus avoiding a probability of the signal portion darkest in the NTSC image display area ARN not being detected.

An output stage of the black level hold circuit 3 is fed back to an input stage through a resistance R2, and also connected to an external resistance R3 and a capacitor C1 connected in parallel through a pin 5, and thus a predetermined supply voltage is fed thereto.

An arrangement is such that by making a resistance value and a capacitance of the resistance R3 and the capacitor C1 variable, the black level correction circuit 1 may change a time constant and set a pulse width of the darkest signal that can be detected by the black level hold circuit 3 from the input video signal V_{IN}.

The black level expansion circuit 6 comprises an operational amplifier, loads the input video signal V_{IN} into an input stage from a node P2 whereat the resistance R1 and the amplification circuit 2 are connected, and also loads a voltage at a node P3 whereat the black level hold circuit 3 and the pin 5 are connected into the input stage.

While a blanking pulse signal S2 inputted from a blanking pulse input terminal 7 falls, that is, other than a blanking duration, the black level expansion circuit 6 lowers the detected black signal level to a pedestal level (FIG. 2C).

The blanking pulse signal S2 is made to fall covering the whole screen display period.

Thus, when an average brightness level in the NTSC image display area ARN is high and the screen is bright, a signal level of the detected darkest video signal V_{IN} can be lowered to a pedestal level, and even in case the black signal portion is slight, a probability that the black signal portion is seen afloat can be avoided effectively.

Further, a brightness level of the input video signal V_{IN} can be lowered covering the display screen overall, and in case the darkest signal levels in the NTSC image display area ARN and the black-framed area ARB are even, a boundary of the display areas ARA and ARB will not be so sensed.

In the aforementioned construction, when a video signal V_{INN} of the NTSC system is inputted instead of the video signal V_{INH} of a so-called high vision system, the black level hold circuit 3 detects the darkest signal level in the display area ARN according to a black level detection signal S1 falling correspondingly to a period of the NTSC image display area ARN.

When an average brightness level of the video signal V_{INN} is high there is less of the black signal, the black level hold circuit 3 does not hold the black signal portion since the darkest signal black level as an area of the black signal in the NTSC image display area ARN (indicated by oblique lines in the NTSC image display area ARN of FIG. 3A) is less than the area of the video signal V_{IN}, the circuit holds a white level signal as the black level.

In this case the black level expansion circuit 6 expands a black signal portion only of the video signal V_{IN} according to the NTSC system for the blanking pulse signal S2 having fallen, thus correcting the video signal V_{IN} to be seen darker than usual.

Then, as in the case of a conventional television receiver for the NTSC system, when operating the black level detection period and the black level expansion period covering the overall display screen area ARA, the black-framed areas ARB on opposite ends of the display area ARA are determined erroneously to be a black level, and thus a probability is that the black signal portion to be expanded essentially will not be expanded.

Thus, from adjusting the black level detection signal S1 so that the black level detection signal S1 does not operate in the black-framed area ARB but operates only in the NTSC image display area ARN, the black level correction circuit 1 is capable of intensifying further a black signal portion of the NTSC system video signal V_{IN}, when the NTSC system image is displayed on a so-called high vision video signal coordinating television receiver.

As shown in FIG. 4A, on the other hand, in case black levels of the video signals V_{IN} inputted correspondingly to the black-framed area ARB and the NTSC image display area ARN are the same, the black level hold circuit 3 operates in the NTSC image display area ARN.

In this case, since the blanking pulse signal S2 is low covering the overall image display area ARA, the black level expansion circuit 6 expands the black signal in the whole image display area ARA including the black-framed area ARB and outputs it from the amplification circuit 2.

A voltage level of an output video signal V_{OUT} becomes to lower by $\Delta\times0$ (mV) from the black reference level, and a general brightness level of the whole image display area ARA seems to be somewhat low, thereby removing a visual difference in level at a boundary portion of the black-framed area ARB and the image area ARN according to the NTSC system (FIG. 4C).

Meanwhile, when the black level detection signal S1 and the blanking pulse signal S2 are adjusted to fall in the NTSC image display area ARN, the black level expansion circuit 6 operates not to the whole image display area ARA but to the image display area ARN only, therefore a difference in level at $\Delta\times1$ (mV) will be sensed visually at a boundary portion of the black-framed area ARB and the image display area ARN according to an offset of the number (mV) to accrue to the black level hold circuit 3 and an offset of the number (mV) to accrue to the black level expansion circuit 6 (FIG. 4B).

Thus, from adjusting the blanking pulse signal S2 to fall so that the black level expansion circuit 6 does not operate in the NTSC image display area ARN central of the screen but operates in the whole image display area ARN according to the NTSC system, when an image of the NTSC system is displayed on a high vision video signal coordinating television receiver, the black level correction circuit 1 is capable of displaying the image in such manner as will not sense visually a boundary portion of the black-framed area ARB

and the image display area ARA according to the NTSC system.

According to the above-described construction, when displaying video signals of the NTSC which is different in aspect ratio on the same screen of a television receiver corresponding to high vision video signals, from detecting a black level of the video signal V_{IN} in the display area ARN corresponding to the video signal of the NTSC system, and expanding the black level within the whole image display area ARA, the black level of the video signal V_{IN} can be detected and expanded in the image area ARN for displaying the image according to the NTSC system, and thus the probability that the black-framed area ARB is detected erroneously as a black level is effectively avoided and the black level of the image area ARN according to the NTSC system is not expanded.

Further, when displaying images in the whole image display area ARA, from expanding the black level covering the whole image display area ARA, a capability of a boundary portion of the black-framed areas ARB on opposite ends of the image area ARA and the NTSC image display area ARN being sensed visually can be avoided effectively.

The above description given for the embodiment has referred to the case where video signals according to the NTSC system which are different in aspect ratio are displayed on a so-called high vision video signal coordinating television receiver, however, the present invention is not necessarily limited thereto, and hence is applicable to a case where video signals which different in aspect ratio from the vision system such as PAL system or the like are displayed.

Further, the above-described embodiment is a exemplified by the case where the black-framed areas ARB are displayed on opposite sides of the NTSC image area ARN, however, the present invention is not necessarily limited thereto, and thus is applicable to a case where the black-framed area ARB is displayed on one side only.

Still further, the above embodiment is exemplified by the case where the darkest signal in the image area ARN is lowered to a pedestal level, however, the present invention is not necessarily limited thereto, and hence it may be lowered to a predetermined level.

Next, another preferred embodiment will be described.

An example where the present invention is applied not to a high vision television system but to a conventional television system will be described. When a cinema size picture which is enhanced in its reality and impression because of its width, is displayed on a conventional television system, it will be a familiar picture as illustrated in FIG. 5.

The dynamic picture function can also be applied to this picture by forming a black level detection signal S3 (FIG. 5B) and a blanking pulse signal S4 (FIG. 5C).

The operation will be described in detail.

When the block level detection signal S3 inputted from the black detection pulse input terminal 4 falls, the black level hold circuit 3 detects and holds the darkest signal level in input video signal V_{IN}. When the black level detection signal S3 rises, the black level hold circuit 3 stops detecting the darkest signal level in the input video signal V_{IN}.

The black level detection signal S3 lowers in the area ARN where the signal is displayed in cinema size (hereinafter referred to as cinema size area) which is within the area ARAX where the NTSC video signal is displayed (hereinafter referred to as NTSC picture display area), whereas it rises at the black margin area ARB at the border of the screen (FIG. 5B).

The black level hold circuit 3 holds the darkest signal level within the cinema size area ARNX, thereby preventing the near black signal in the top and bottom black margin area ARBX instead of the darkest signal in the cinema size area ARNX from being detected.

The black level correction circuit 1, by varying the resistance of resistor R3 and the capacitance of capacitor C1, changes the time constant and sets the pulse width of the darkest signal that the black level hold circuit 3 can detect from the input video signal V_{IN}.

The black level expansion circuit 6, while the blanking pulse S4 inputted from the blanking pulse input terminal 7 lowers, i.e. while it is outside the blanking period, lowers the detected black signal level to the pedestal level.

Here, the blanking pulse signal S4 lowers through out the entire screen display period.

Therefore, when the average brightness level in the cinema size area ARNX is high such that the display is bright, the circuit lowers the darkest detected video signal V_{IN} to the pedestal level, thereby preventing the black signal portion from seemingly floating even when the black signal portion is small.

Also because of this, the brightness level of the input video signal throughout the display screen can be lowered, thereby preventing the border between the cinema size area ARNX and the black margin area ARBX from being noticeable when the darkest signal level in the cinema size area ARNX and the black margin area ARBX are equal.

When the average brightness level of the input video signal V_{IN} is high and does not have much black signal, the black level hold circuit, because the area of the black signal (shown with oblique lines in the cinema size area ARNX in FIG. 6A) within the cinema size area ARNX is small compared to the area of the inputted video signal V_{IN}, does not hold the black signal portion as the darkest black signal level, and instead, holds the white level signal as the black level. Here, the black level expansion circuit 6, because the blanking pulse signal S4 is dropping, expands only the black signal portion of the video signal V_{IN} within the cinema size area and thereby corrects the video signal so as to make it look more black.

As described above, according to the present invention, when an image is displayed in a first display screen having a first aspect ratio, the black level of a video signal is lowered to a predetermined level covering an overall display screen, thereby avoiding effectively a probability that a boundary of a second display screen and an extra area outward of the second display screen is sensed visually.

Further, when an image are displayed in the second display screen having a second aspect ratio, a black signal in a video signal is detected only within the second display screen, and the black signal is not detected in the extra screen, therefore a black level in the second display screen can be lowered to a predetermined level.

While there has been described in connection with the preferred embodiments of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is aimed, therefore, to cover in the appended claims all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A display unit, comprising:

a first display screen area having a first aspect ratio;

a second display screen area having a second aspect ratio;

a black frame area partially bordering said second display screen area;

signal level expansion means for lowering a darkest signal level in an image of a display unit to a predetermined level when said image is displayed in said first display screen area;

signal level detecting means for detecting a darkest signal level of an image in said second display screen area when said image is displayed in said second display screen area, said signal level detecting means ignoring said black frame area when detecting a darkest signal level; and

said signal level expansion means lowering a darkest signal level in an image of said display unit to a predetermined level when said image is displayed on said second display screen area based on a detected result of said signal level detecting means.

2. A display unit as claimed in claim **1**, wherein said first aspect ratio is further defined by a 16 to 9 aspect ratio, and wherein said second aspect ratio is further defined by a 4 to 3 aspect ratio.

3. A display unit comprising:

a first display screen having a first aspect ratio;

a second display screen having a second aspect ratio;

a black frame area partially bordering said second display screen;

signal level detection means for detecting a darkest signal level of an image in said second display screen when said image is displayed in said second display screen; and

signal level expansion means, electrically connected to said signal level detection means, for lowering said darkest signal level to a predetermined level based on a detected result of said signal level detection means.

4. A display unit as claimed in claim **3**, wherein said first aspect ratio is further defined by a 16 to 9 aspect ratio, and wherein said second aspect ratio is further defined by a 4 to 3 aspect ratio.

5. A display unit as claimed in claim **3**, further comprising variable time constant means for varying the pulse width of said darkest signal level detected by said signal level detection means, said variable pulse width means being electrically connected to said signal level detection means and to said signal level expansion means.

6. A method for lowering a black level in a display unit comprising the steps of:

setting a first black level in a first display screen having a first aspect ratio;

setting a second black level and a second display screen having a second aspect ratio;

detecting a darkest signal of a video signal from an image area corresponding to said second display screen, excepting a black frame region partially bordering said second display screen; and

lowering said darkest signal to a predetermined level in an image area corresponding to said first display screen.

7. A method as claimed in claim **6**, wherein said first aspect ratio is further defined by a 16 to 9 aspect ratio and wherein said second aspect ratio is further defined by a 4 to 3 aspect ratio.

8. A method as claimed in claim **6**, further comprising the step of varying a pulse width of said darkest signal level.

* * * * *

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UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF CALIFORNIA

NOTICE OF ASSIGNMENT TO UNITED STATES MAGISTRATE JUDGE FOR DISCOVERY

This case has been assigned to District Judge Alicemarie H. Stotler and the assigned discovery Magistrate Judge is Arthur Nakazato.

The case number on all documents filed with the Court should read as follows:

SACV08- 1135 AHS (ANx)

Pursuant to General Order 05-07 of the United States District Court for the Central District of California, the Magistrate Judge has been designated to hear discovery related motions.

All discovery related motions should be noticed on the calendar of the Magistrate Judge

==========

NOTICE TO COUNSEL

A copy of this notice must be served with the summons and complaint on all defendants (if a removal action is filed, a copy of this notice must be served on all plaintiffs).

Subsequent documents must be filed at the following location:

[ ] **Western Division**
312 N. Spring St., Rm. G-8
Los Angeles, CA 90012

[X] **Southern Division**
411 West Fourth St., Rm. 1-053
Santa Ana, CA 92701-4516

[ ] **Eastern Division**
3470 Twelfth St., Rm. 134
Riverside, CA 92501

Failure to file at the proper location will result in your documents being returned to you.

Steven M. Anderson (Bar No. 144014)
QUINN EMANUEL URQUHART OLIVER & HEDGES, LLP
865 S. Figueroa Street, 10th Floor
Los Angeles, California 90017 tel: (213) 443-3000

UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF CALIFORNIA

SONY CORPORATION, A Japanese corporation,

PLAINTIFF(S)

v.

VIZIO, Inc.,

DEFENDANT(S).

CASE NUMBER

SACV08-1135 AHS (JWx)

SUMMONS

TO: DEFENDANT(S): VIZIO, Inc.

A lawsuit has been filed against you.

Within 20 days after service of this summons on you (not counting the day you received it), you must serve on the plaintiff an answer to the attached ☑ complaint ☐ _____ amended complaint ☐ counterclaim ☐ cross-claim or a motion under Rule 12 of the Federal Rules of Civil Procedure. The answer or motion must be served on the plaintiff's attorney, Steven M. Anderson, whose address is 865 S. Figueroa Street, 10th Floor, Los Angeles, California 90017. If you fail to do so, judgment by default will be entered against you for the relief demanded in the complaint. You also must file your answer or motion with the court.

Clerk, U.S. District Court

Dated: OCT 10 2008

By: NATALIE LONGORIA
Deputy Clerk

(Seal of the Court)

[Use 60 days if the defendant is the United States or a United States agency, or is an officer or employee of the United States. Allowed 60 days by Rule 12(a)(3)].

1198

UNITED STATES DISTRICT COURT, CENTRAL DISTRICT OF CALIFORNIA
CIVIL COVER SHEET

I (a) PLAINTIFFS (Check box if you are representing yourself ☐)
SONY CORPORATION, A Japanese corporation

DEFENDANTS
VIZIO, Inc.

(b) Attorneys (Firm Name, Address and Telephone Number. If you are representing yourself, provide same.)

QUINN EMANUEL URQUHART OLIVER & HEDGES, LLP
865 S. Figueroa Street, 10th Floor
Los Angeles, California 90017 Tel: (213) 443-3000

Attorneys (If Known)

unknown

II. BASIS OF JURISDICTION (Place an X in one box only.)

☐ 1 U.S. Government Plaintiff ☑ 3 Federal Question (U.S. Government Not a Party)

☐ 2 U.S. Government Defendant ☐ 4 Diversity (Indicate Citizenship of Parties in Item III)

III. CITIZENSHIP OF PRINCIPAL PARTIES - For Diversity Cases Only
(Place an X in one box for plaintiff and one for defendant.)

	PTF	DEF		PTF	DEF
Citizen of This State	☐ 1	☐ 1	Incorporated or Principal Place of Business in this State	☐ 4	☐ 4
Citizen of Another State	☐ 2	☐ 2	Incorporated and Principal Place of Business in Another State	☐ 5	☐ 5
Citizen or Subject of a Foreign Country	☐ 3	☐ 3	Foreign Nation	☐ 6	☐ 6

IV. ORIGIN (Place an X in one box only.)

☑ 1 Original Proceeding ☐ 2 Removed from State Court ☐ 3 Remanded from Appellate Court ☐ 4 Reinstated or Reopened ☐ 5 Transferred from another district (specify): ☐ 6 Multi-District Litigation ☐ 7 Appeal to District Judge from Magistrate Judge

V. REQUESTED IN COMPLAINT: **JURY DEMAND:** ☑ Yes ☐ No (Check 'Yes' only if demanded in complaint.)

CLASS ACTION under F.R.C.P. 23: ☐ Yes ☑ No ☐ **MONEY DEMANDED IN COMPLAINT:** $ to be proved at trial

VI. CAUSE OF ACTION (Cite the U.S. Civil Statute under which you are filing and write a brief statement of cause. Do not cite jurisdictional statutes unless diversity.)
Counts 1-14: violation of 35 U.S.C. 271 (Patent Infringement)

VII. NATURE OF SUIT (Place an X in one box only.)

OTHER STATUTES
- ☐ 400 State Reapportionment
- ☐ 410 Antitrust
- ☐ 430 Banks and Banking
- ☐ 450 Commerce/ICC Rates/etc.
- ☐ 460 Deportation
- ☐ 470 Racketeer Influenced and Corrupt Organizations
- ☐ 480 Consumer Credit
- ☐ 490 Cable/Sat TV
- ☐ 810 Selective Service
- ☐ 850 Securities/Commodities/ Exchange
- ☐ 875 Customer Challenge 12 USC 3410
- ☐ 890 Other Statutory Actions
- ☐ 891 Agricultural Act
- ☐ 892 Economic Stabilization Act
- ☐ 893 Environmental Matters
- ☐ 894 Energy Allocation Act
- ☐ 895 Freedom of Info. Act
- ☐ 900 Appeal of Fee Determination Under Equal Access to Justice
- ☐ 950 Constitutionality of State Statutes

CONTRACT
- ☐ 110 Insurance
- ☐ 120 Marine
- ☐ 130 Miller Act
- ☐ 140 Negotiable Instrument
- ☐ 150 Recovery of Overpayment & Enforcement of Judgment
- ☐ 151 Medicare Act
- ☐ 152 Recovery of Defaulted Student Loan (Excl. Veterans)
- ☐ 153 Recovery of Overpayment of Veteran's Benefits
- ☐ 160 Stockholders' Suits
- ☐ 190 Other Contract
- ☐ 195 Contract Product Liability
- ☐ 196 Franchise

REAL PROPERTY
- ☐ 210 Land Condemnation
- ☐ 220 Foreclosure
- ☐ 230 Rent Lease & Ejectment
- ☐ 240 Torts to Land
- ☐ 245 Tort Product Liability
- ☐ 290 All Other Real Property

TORTS PERSONAL INJURY
- ☐ 310 Airplane
- ☐ 315 Airplane Product Liability
- ☐ 320 Assault, Libel & Slander
- ☐ 330 Fed. Employers' Liability
- ☐ 340 Marine
- ☐ 345 Marine Product Liability
- ☐ 350 Motor Vehicle
- ☐ 355 Motor Vehicle Product Liability
- ☐ 360 Other Personal Injury
- ☐ 362 Personal Injury-Med Malpractice
- ☐ 365 Personal Injury-Product Liability
- ☐ 368 Asbestos Personal Injury Product Liability

IMMIGRATION
- ☐ 462 Naturalization Application
- ☐ 463 Habeas Corpus-Alien Detainee
- ☐ 465 Other Immigration Actions

TORTS PERSONAL PROPERTY
- ☐ 370 Other Fraud
- ☐ 371 Truth in Lending
- ☐ 380 Other Personal Property Damage
- ☐ 385 Property Damage Product Liability

BANKRUPTCY
- ☐ 422 Appeal 28 USC 158
- ☐ 423 Withdrawal 28 USC 157

CIVIL RIGHTS
- ☐ 441 Voting
- ☐ 442 Employment
- ☐ 443 Housing/Accommodations
- ☐ 444 Welfare
- ☐ 445 American with Disabilities - Employment
- ☐ 446 American with Disabilities - Other
- ☐ 440 Other Civil Rights

PRISONER PETITIONS
- ☐ 510 Motions to Vacate Sentence Habeas Corpus
- ☐ 530 General
- ☐ 535 Death Penalty
- ☐ 540 Mandamus/ Other
- ☐ 550 Civil Rights
- ☐ 555 Prison Condition

FORFEITURE/ PENALTY
- ☐ 610 Agriculture
- ☐ 620 Other Food & Drug
- ☐ 625 Drug Related Seizure of Property 21 USC 881
- ☐ 630 Liquor Laws
- ☐ 640 R.R. & Truck
- ☐ 650 Airline Regs
- ☐ 660 Occupational Safety /Health
- ☐ 690 Other

LABOR
- ☐ 710 Fair Labor Standards Act
- ☐ 720 Labor/Mgmt. Relations
- ☐ 730 Labor/Mgmt. Reporting & Disclosure Act
- ☐ 740 Railway Labor Act
- ☐ 790 Other Labor Litigation
- ☐ 791 Empl. Ret. Inc. Security Act

PROPERTY RIGHTS
- ☐ 820 Copyrights
- ☑ 830 Patent
- ☐ 840 Trademark

SOCIAL SECURITY
- ☐ 861 HIA (1395ff)
- ☐ 862 Black Lung (923)
- ☐ 863 DIWC/DIWW (405(g))
- ☐ 864 SSID Title XVI
- ☐ 865 RSI (405(g))

FEDERAL TAX SUITS
- ☐ 870 Taxes (U.S. Plaintiff or Defendant)
- ☐ 871 IRS-Third Party 26 USC 7609

SACV08-1135

FOR OFFICE USE ONLY: Case Number: _____

AFTER COMPLETING THE FRONT SIDE OF FORM CV-71, COMPLETE THE INFORMATION REQUESTED BELOW.

UNITED STATES DISTRICT COURT, CENTRAL DISTRICT OF CALIFORNIA
CIVIL COVER SHEET

VIII(a). IDENTICAL CASES: Has this action been previously filed in this court and dismissed, remanded or closed? ☑ No ☐ Yes
If yes, list case number(s): _____

VIII(b). RELATED CASES: Have any cases been previously filed in this court that are related to the present case? ☐ No ☑ Yes
If yes, list case number(s): CV08-03934 RGK (FMOx)

Civil cases are deemed related if a previously filed case and the present case:
(Check all boxes that apply) ☐ A. Arise from the same or closely related transactions, happenings, or events; or
☑ B. Call for determination of the same or substantially related or similar questions of law and fact; or
☑ C. For other reasons would entail substantial duplication of labor if heard by different judges; or
☑ D. Involve the same patent, trademark or copyright, and one of the factors identified above in a, b or c also is present.

IX. VENUE: (When completing the following information, use an additional sheet if necessary.)

(a) List the County in this District; California County outside of this District; State if other than California; or Foreign Country, in which **EACH** named plaintiff resides.
☐ Check here if the government, its agencies or employees is a named plaintiff. If this box is checked, go to item (b).

County in this District:*	California County outside of this District; State, if other than California; or Foreign Country
	Sony Corporation: citizen of Japan;

(b) List the County in this District; California County outside of this District; State if other than California; or Foreign Country, in which **EACH** named defendant resides.
☐ Check here if the government, its agencies or employees is a named defendant. If this box is checked, go to item (c).

County in this District:*	California County outside of this District; State, if other than California; or Foreign Country
VIZIO, Inc. - Orange County, California	

(c) List the County in this District; California County outside of this District; State if other than California; or Foreign Country, in which **EACH** claim arose.
Note: In land condemnation cases, use the location of the tract of land involved.

County in this District:*	California County outside of this District; State, if other than California; or Foreign Country
Claims 1-14: Los Angeles County	

*** Los Angeles, Orange, San Bernardino, Riverside, Ventura, Santa Barbara, or San Luis Obispo Counties**
Note: In land condemnation cases, use the location of the tract of land involved

X. SIGNATURE OF ATTORNEY (OR PRO PER): _____ Date October 10, 2008

Notice to Counsel/Parties: The CV-71 (JS-44) Civil Cover Sheet and the information contained herein neither replace nor supplement the filing and service of pleadings or other papers as required by law. This form, approved by the Judicial Conference of the United States in September 1974, is required pursuant to Local Rule 3-1 is not filed but is used by the Clerk of the Court for the purpose of statistics, venue and initiating the civil docket sheet. (For more detailed instructions, see separate instructions sheet.)

Key to Statistical codes relating to Social Security Cases:

Nature of Suit Code	Abbreviation	Substantive Statement of Cause of Action
861	HIA	All claims for health insurance benefits (Medicare) under Title 18, Part A, of the Social Security Act, as amended. Also, include claims by hospitals, skilled nursing facilities, etc., for certification as providers of services under the program. (42 U.S.C. 1935FF(b))
862	BL	All claims for "Black Lung" benefits under Title 4, Part B, of the Federal Coal Mine Health and Safety Act of 1969. (30 U.S.C. 923)
863	DIWC	All claims filed by insured workers for disability insurance benefits under Title 2 of the Social Security Act, as amended; plus all claims filed for child's insurance benefits based on disability. (42 U.S.C. 405(g))
863	DIWW	All claims filed for widows or widowers insurance benefits based on disability under Title 2 of the Social Security Act, as amended. (42 U.S.C. 405(g))
864	SSID	All claims for supplemental security income payments based upon disability filed under Title 16 of the Social Security Act, as amended.
865	RSI	All claims for retirement (old age) and survivors benefits under Title 2 of the Social Security Act, as amended. (42 U.S.C. (g))